The MINING CONGRESS JOURNAL

Volume 12 MARCH, 1926 *No.* 3

SOUTHERN DEVELOPMENT NUMBER

Southern Industrial Development Conference
High Grade Clays of Southeastern States
White Clays and Kaolin in 1925
Possibilities of Eastern Oil Shales
Gypsum and the Gypsum Industry
Mica Industry in the United States
Slate an Excellent Building Material
Developing the Fluorspar Industry
Economic Growth of the South

MECHANICAL LOADING IN METAL MINES

Scrapers in Underground Loading
Mechanical Loading at United Verde and Bennett Mines
Mechanical Loading in Driving Moffatt, Hetch Hetchy, and Big Creek Tunnels

BLASTING AND LUMP COAL

Driving Rooms off Face
Drill Holes and their Placement
Large Sizes in Low Volatile Coal
Control of Coal Sizes

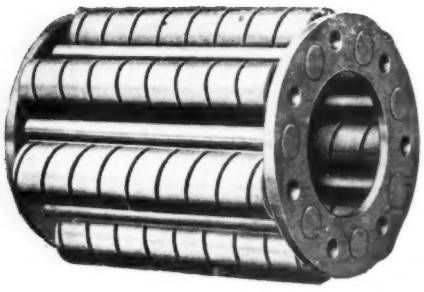
The Revenue Act of 1926
The Legislative Review
The Nation's Viewpoint
Practical Operating Men's Department

Contributors:

Hon. Duncan U. Fletcher, W. M. Weigel, R. T. Vanderbilt, C. S. Crouse, Frank A. Wilder, S. Herbert Brown, W. S. Hays, James A. Green, Lucien Eaton, W. V. DeCamp, A. E. Schneider, N. A. Eckart, D. H. Reininger, C. A. Betts, J. E. Tiffany, C. W. Nelson, W. J. German, Howard M. Shaul.

JOHN W. SHEERES

How Much is Your Contribution to Friction?



The picture at the top of this page shows 25 cubic foot Hyatt equipped Matteson ore cars at the Estella Mines, east of Keeler in the Cerro Gordo district, California. Cars were manufactured by Joshua Hendy Iron Works, San Francisco, California.

WERE it possible to accurately compute the losses through friction to the metal producers, the industry would stand aghast. Take your own mine—how much is your contribution to friction? Your ore cars with plain bearings are devouring power that could be utilized to increase tonnage and reduce haulage costs.

A host of ore cars equipped with Hyatt Roller Bearings are daily demonstrating their extraordinary power saving qualities.

Gradually convert your ore cars from plain to Hyatt bearings. It means a tremendous saving in power and lubricants; eliminates wheel replacements; insures positive lubrication; and permits more cars per trip. Hyatt installations pay. Write for information. Hyatt Roller Bearing Company, Newark, Huntington, Chicago.

HYATT

ROLLER BEARINGS

Send It To Your Men
—*The Explosives Engineer*

Devoted to the Technology of Drilling, Blasting, Loading and Transportation of Coal, Ore and Stone

What more profitable investment can you make than to spend slightly less than three cents a month on each man in your organization who is in a position to apply the wealth of practical, usable information for the improvement of drilling, blasting, and allied operations contained in each issue of The Explosives Engineer?

In April, for instance, there is an article by E. H. Johnson on "Blasting Coal for Mechanical Loading," which covers this subject clearly and thoroughly. Those interested in hard rock mining will find in "Mining Methods of The Cresson Gold Mining Company" some practical explosives data. The construction engineer of the Queenston-Chippewa hydro-electric canal tells about that unusual project which, when completed, will utilize a part of Niagara's wasted energy. "Mining for Oil" describes a new process of extracting petroleum from oil sands. And, of course, a Blaster Bill cartoon and the usual bibliography of all articles on drilling and blasting and a list of new patents, digested from the technical press of the world.

Our new subscription rate—*Three Years for One Dollar*—is less than might reasonably be asked, but executives tell us they would like to have their superintendents, foremen, safety engineers and other officials read The Explosives Engineer regularly. Therefore, we have gone as far as we could to encourage this.

Just write on the coupon below the name of each employee for whom your company wishes to subscribe to The Explosives Engineer. If you mail it now they will not miss the next issue.

THE EXPLOSIVES ENGINEER

WILMINGTON *Published Monthly* DELAWARE

THE EXPLOSIVES ENGINEER
934 Delaware Trust Bldg.
Wilmington, Delaware

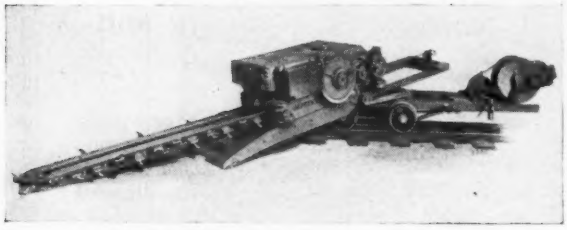
SUBSCRIPTION RATES
United States—3 yrs. $1.00; 1 yr. $0.50
Other Countries—3 yrs. 2.00; 1 yr. 1.00

Please enter the following subscriptions to The Explosives Engineer, to begin with the current issue.

Name	Position	Company	Street	City	State

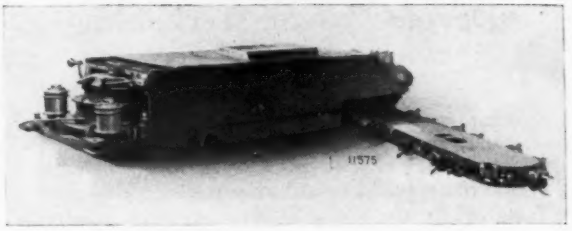
A COMPLETE LINE FOR CUTTING, LOADING, HANDLING & VENTILATING

ACCEPTED STANDARDS
IN COAL MINING MACHINES



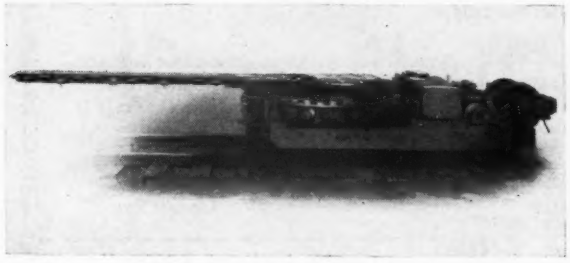
35-B SHORTWALL Coal Cutter (Trade Mark—Reg. U. S. Pat. Office)

Light in weight, but powerful and rugged. Easily repaired. Follows rolly bottom. Concentrated control insures ease of operation. Feed and Handling Mechanism operated independently, giving flexible control. Accessible in all wearing parts.



24-A LONGWALL Coal Cutter

Especially designed to occupy small space to facilitate placing timbers close to the face. Single Reduction Worm and Worm Gear Drive between the motor and sprocket insures quiet operation. Cutter Bar mounted so that it can be swung 180 degrees.



29-C ARCWALL Coal Cutter (Trade Mark—Reg. U. S. Pat. Office)

Adjustable in all directions. Cuts in dirt or shale bands—at top, bottom, or at any height in coal seam. No loading, unloading or slack shoveling. Produces more lump coal because light charges of powder may be used. Top cutting lessens danger to roof.

29-C ARCWALL Bottom Cutter

The only mining machine which will actually cut directly on the bottom. When in position for cutting the long down bits are the lowest part. No wedge shaped portions of bottom are left, and the expense of taking up bottom is entirely eliminated.

Whatever your conditions or system of mining employed, you will find it profitable to take up your cutting, drilling, loading, hauling, handling or ventilating problems with experienced Jeffrey Engineers—men who know the requirements of the coal mining industry.

THE ELECTRIC POWER CLUB
Member - of - the Electric Power Club

The Jeffrey Manufacturing Company
958-99 North Fourth St., Columbus, Ohio

New York, Philadelphia, Pittsburgh, Scranton, Pa., Charleston, W. Va., Chicago, Denver, Salt Lake City, Birmingham, Montreal, Canada

Sales and Service Stations
Pittsburgh.....600 Second Ave. Terre Haute, Ind.....319 Cherry St.

JEFFREY
COAL MINE EQUIPMENT

Jeffrey-Standard Coal Mine Equipment
Coal Cutters
Combination Cutter and Loader
Drills
Conveyor-Loader
Sectional Conveyor
Pit Car Loaders
Locomotives
Mine Fans
Tipple Equipment
Crushers

THE MINING CONGRESS JOURNAL

MARCH, 1926 CONTENTS $3.00 Per Year 30c Per Copy

EDITORIALS

Taxing the Mining Industry 149
Hands Off Transportation 150
The Farmer and the Tariff 150
Kaiser Bill and Czar Lewis 151
Fact-Finding Committees 151
Industrial Development of the South 151
The Big Question 152
Opening the Door 152

FEATURE ARTICLES

Southern Industrial Development Conference 154
Gypsum and the Gypsum Industry—By Frank A. Wilder 156
High-Grade Clays of the Southeastern States—By W. M. Weigel 157
White Clays and Kaolin in 1925—By R. T. Vanderbilt.. 162
Economic Possibilities of Eastern Oil Shales—By C. S. Crouse 166
The Mica Industry in the United States—By S. Herbert Brown 170
Slate—An Ancient and Excellent Building Material—By W. S. Hays 172
Economic Growth of the South—By Duncan U. Fletcher 174
Developing the Fluorspar Industry—By James A. Green 176
The Revenue Act of 1926 178
Legislative Review 179
Hoover Committee Makes Recommendations 189
Scrapers in Underground Loading—Development and Present Methods—By Lucien Eaton 195
Underground Mechanical Loading at United Verde—By W. V. De Camp 197
Mechanical Loading Underground at the Bennett Mine—By A. E. Schneider 200
Mechanical Loaders in Driving Hetch Hetchy Tunnels—By N. A. Eckart 202
Mechanical Loaders in Tunnel Driving at Big Creek—By D. H. Redinger 206
Mechanical Loading at the Moffatt Tunnel—By C. A. Betts 210
Increasing the Production of Lump Coal with Rooms Driven Off Face—By J. E. Tiffany 213

FEATURE ARTICLES—Continued

Relation of Drill Holes and Their Placement to Lump Coal—By C. W. Nelson 217
Blasting for Large Sizes in Low Volatile Coal—By W. J. German 219
Control of Coal Sizes with Uniform Preparation, Drilling, and Shooting—By Howard M. Shaul 220

DEPARTMENTS

PRACTICAL OPERATING MEN'S DEPARTMENT, METALS 195
PRACTICAL OPERATING MEN'S DEPARTMENT, COAL 213
THE NATION'S VIEWPOINT 222
NEWS OF THE MINING FIELD 228
WITH THE MANUFACTURERS 233

NEWS

Annual Meeting of American Institute of Mining Engineers 188
Explosive Consumption 194
Metal Mine Accidents in 1924 196
Stream Pollution 209
Story of Dynamite 212
Bureau of Mines Funds 216
Committee to Study Mining Loading Problems 229

PRACTICAL OPERATING MEN'S DEPARTMENT

Scrapers In Underground Loading—Development And Present Methods

Underground Mechanical Loading At United Verde

Mechanical Loading Underground At The Bennett Mine

Mechanical Loaders In Driving Hetch Hetchy Tunnels

Mechanical Loaders In Tunnel Driving At Big Creek

Mechanical Loading At The Moffatt Tunnel

Increasing The Production Of Lump Coal With Rooms Driven Off Face

Relation Of Drill Holes And Their Placement To Lump Coal

Blasting For Large Sizes In Low Volatile Coal

Control Of Coal Sizes With Uniform Preparation, Drilling and Shooting

Published Every Month by the American Mining Congress, Washington, D. C.

JAMES F. CALLBREATH
Editor-in-Chief

E. R. COOMBES
Editor

MCKINLEY W. KRIEGH
Assistant Editor

GUY N. BJORGE
Associate Editor

NEWELL G. ALFORD
Associate Editor

ERNEST H. PULLMAN
Legislative Editor

F. E. PRIOR
Art Editor

L. R. HUDSON
Field Representative

Entered as Second Class Mail Matter January 30, 1915, at the Post Office at Washington, D. C.

Steels That Fight Destruction

Agathon Alloy Steels are closely refined steels to which have been added certain other metals, such as Nickel, Vanadium, Molybdenum, etc. They provide superlative steel strength with a minimum of bulk and weight. They are steels that fight destruction.

Use these steels in the highly stressed and wearing parts of your mining equipment. Means fewer delays for repairs and longer life for machines. Let our metallurgists advise you what analysis of steel is best suited to your requirements. Ask for booklet, "Agathon Alloy Steels."

We have daily production in all kinds of Agathon Alloy Steel such as—

Nickel, Chrome-Nickel, UMA, Molybdenum, Chrome-Molybdenum, Nickel-Molybdenum, Vanadium, Chrome-Vanadium, Chromium, etc.

Deliveries in Blooms, Billets, Slabs, Bars, Spring Flats, Hot Rolled Strips, etc.

THE CENTRAL STEEL COMPANY, Massillon, Ohio

Swetland Bldg., Cleveland — Book Bldg., Detroit — Peoples Gas Bldg., Chicago
Aeolian Bldg., New York — University Block, Syracuse — Widener Bldg., Philadelphia
303 W. P. Story Bldg., Los Angeles, California

AGATHON ALLOY STEELS

Shouldering a 24-hour-a-day responsibility

Your pump motor, tucked away in a remote part of your workings, shoulders a responsibility more serious perhaps than that of any other motor in your mine. This motor must keep everlastingly at it—driving, driving hour after hour, twenty-four hours a day.

G-E Motors are built especially for such responsibility. They are driving mine pumps in hundreds of mines—many of them in your immediate locality. Their sturdy, balanced mechanical and electrical construction makes them exceptionally trouble-free—and unfailing.

G-E engineers, trained in the field, will gladly help you select the sizes and types of motors for mine pump duty, according to your needs.

Ask your nearest G-E sales office for complete information as to your requirements.

General Electric supplies electrical equipment for all phases of mine operation. Consider G-E apparatus whenever your requirements are electrical—for G-E installations pay you as surely as good investment bonds. Your nearest G-E office has mine specialists always at your service.

TA-59

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL LARGE CITIES

National Exposition

of The American

Cutting costs in coal operation depends primarily upon greater and more efficient use of mining machinery. Safe, profitable and economical use of equipment will be the purpose behind all discussions and back of every exhibit at Third Annual Convention of Coal Mine Operators and National Exposition of Coal Mine Equipment.

These annual meetings of operating officials mark a big step forward in coal mine operation and meet a need long felt by all mines, from the largest to the smallest—a need that could not be efficiently met otherwise.

The May edition of the Mining Congress Journal will outline this convention fully in advance with program of discussion and description of equipment exhibits — watch for this issue but arrange now to attend.

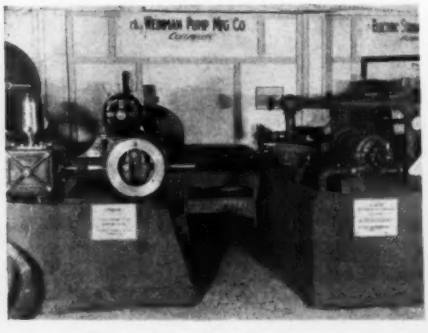
Four days of live and helpful discussions—experiences and opinions related candidly by leaders in the many practical phases of coal mining.

Exhibits covering every kind of mining machinery, enabling the prospective purchaser of mine equipment to make actual comparisons and help him to fit the machine to his needs.

Such is a brief description of the Convention and Annual Exposition of Coal Mining Equipment to be held in Cincinnati, Ohio, from May 24 to 28.

"Safe, Profitable, Economical Production"

MAY



Coal Mine Equipment

Mining Congress

These meetings have marked advancement in two ways; in the progress made possible in the mechanics of mining; in the remarkably wide and practical way this progress has been grasped and applied by the mass of those attending.

This year's convention offers even greater opportunities. The success of the previous meetings has been so marked and the scope and importance of discussions and exhibits have been so recognized as to have made it possible to greatly increase the value of the convention each year. The unusually heavy demand for exhibition space promises an exhibition that will surpass anything of its kind ever shown.

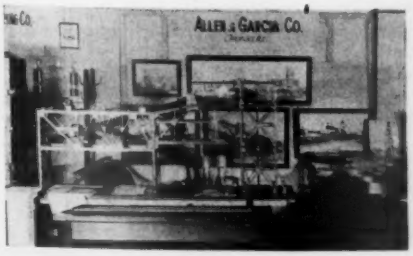
Attendance at this meeting will bring about a closer understanding between those in charge of various operating departments of a coal mine.

The May issue of the Mining Congress Journal will be the official convention number. It will carry the program of subjects with names of discussion leaders and give a graphic description of all exhibits. It will give you an opportunity to plan in advance how to spend your time at Cincinnati.

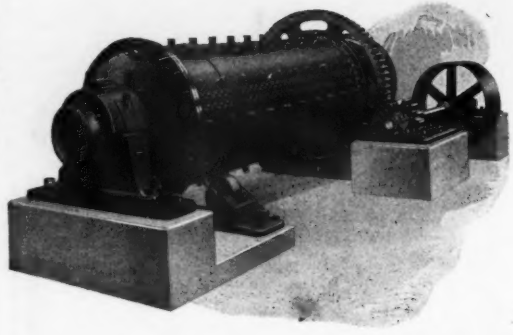
Reduced railway fares may be obtained upon all roads by writing to Mr. John E. Miller, Convention Manager, 841 Munsey Building, Washington, D. C.

Music Hall, Cincinnati, Ohio

24-28



ROD MILLS

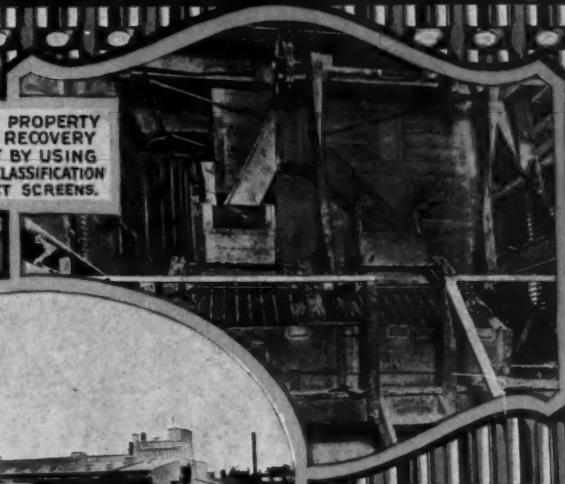


Allis-Chalmers Rod Mills embody the same rugged construction, high grade material and workmanship, characterized in the Ball Granulator.

ALLIS-CHALMERS

MILWAUKEE, WIS. U.S.A.

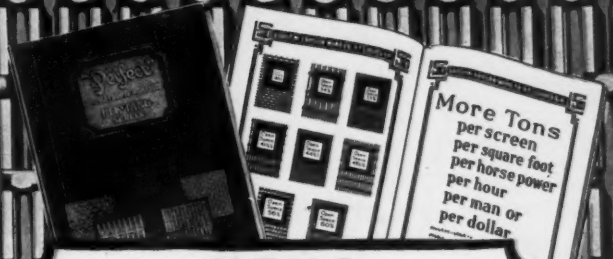
"Perfect" Results in the Screening plant
Reflect in every subsequent process



GREAT COPPER PROPERTY GETS MAXIMUM RECOVERY AT LOWEST COST BY USING "Perfect" SCREEN CLASSIFICATION WITH 150 IMPACT SCREENS.

"Perfect" SCREEN SEPARATION WITH IMPACT SCREENS CUTS COSTS IN MODERN LEAD PRODUCTION.

THE HIGHEST QUALITY OF PRODUCT FOLLOWS "Perfect" SCREENING ON MODERN IMPACT SCREENS



Ludlow-Saylor Wire Cloth

properly selected and applied to screening equipments, saves power, time, attendance and replacement costs, improves the product and increases output.

Choose the *Right* Wire Cloth, and screening equipments will turn out cleaner, more uniform work, require less attendance and power, and *handle more tons* per screen, per square foot, per horsepower, per man, per hour and per dollar.

-oo- -oo- -oo-

The Ludlow-Saylor Screen Book is a Text-Book on Wire Cloth. Engineers and Operating Departments everywhere depend on it for handy, reliable and intelligent Wire Cloth data. The comprehensive tables list A Thousand Standard Screens by mesh—and then re-list them all by openings. Hundreds of full size illustrations simplify selection; and 5000 actual Wire Cloth samples, always at your command, facilitate comparative tests. They make easy a discriminate choice of new screen surfaces, or a positive check on the screens you have been using.

Send for your copy of Screen Book No. 47-D1—the Text-Book on Screens • Free on request, of course—no obligation.

All views are courtesy of the Colorado Iron Works Co., makers of the Impact Screen

MEMO

THE LUDLOW-SAYLOR WIRE CO.
608 South Newstead Ave., St. Louis

Send us your New General Catalogue No. 47-D1. We use

☐ Grinding Equipment ☐ Filter Equipment
☐ Screening Equipment ☐ Tumbling Equipment

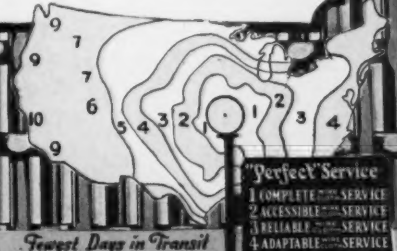
....

Send samples as follows: .....

FIRM .....

By .....

City ..... State .....



Fewest Days in Transit

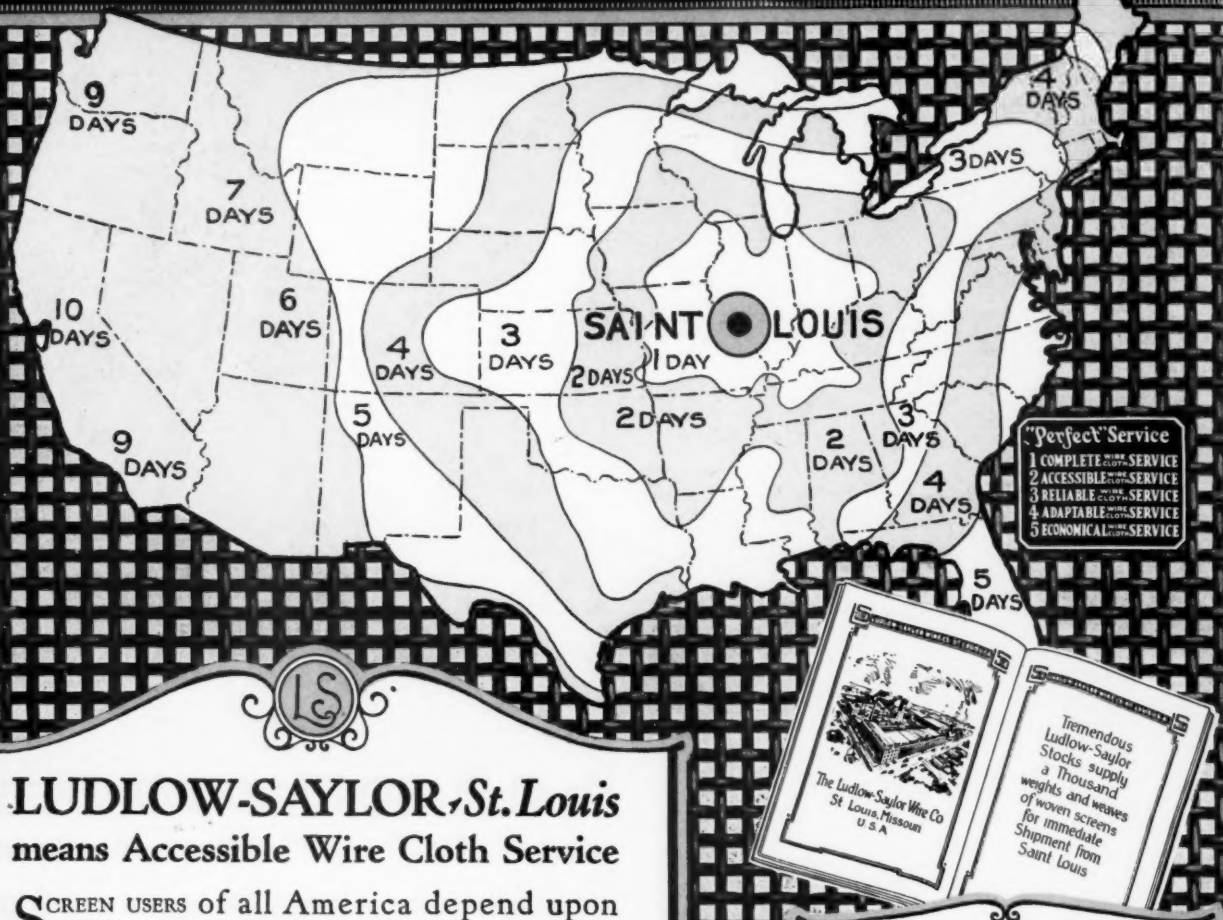
"Perfect" Service
1 COMPLETE ..... SERVICE
2 ACCESSIBLE ..... SERVICE
3 RELIABLE ..... SERVICE
4 ADAPTABLE ..... SERVICE
5 ECONOMICAL ..... SERVICE

The LUDLOW-SAYLOR WIRE COMPANY St. Louis

608 South Newstead Ave.

Nearest to your Needs

Quickest Shipment-Fewest Days in Transit



The Ludlow-Saylor Wire Co
St Louis, Missouri
U S A
Tremendous Ludlow-Saylor Stocks supply a Thousand weights and weaves of woven screens for immediate Shipment from Saint Louis

LUDLOW-SAYLOR-*St. Louis*
means Accessible Wire Cloth Service

SCREEN USERS of all America depend upon St. Louis for complete, reliable, economical and quickly accessible Wire Cloth Service.

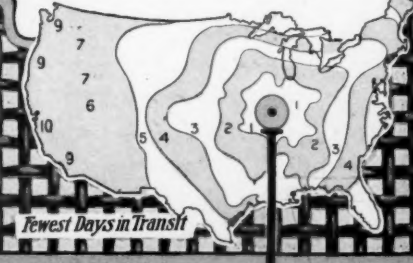
Tremendous Ludlow-Saylor stocks supply a thousand weights and weaves of woven screens, in standard widths. Ordinary specifications are shipped same day order is received. Modern looms make any special screen in the promptest, best and least expensive way.

Package Car Delivery from St. Louis Puts Ludlow-Saylor Service Nearest to Your Needs. Over 26 great Railway systems, 1200 Package Cars leave St. Louis daily, for expedited deliveries to all America — regular freight rates — no extras — fewest days in transit.

Mark all Requisitions—
"*By Package Car from St. Louis.*"

List of Cities and Days to reach them
By Package Car from St. Louis
Regular freight rates—no extras

City	Days	City	Days
Albuquerque, N. M.	5	Little Rock, Ark.	2
Atlanta, Ga.	3	Los Angeles, Calif.	9
Baltimore, Md.	4	Louisville, Ky.	1
Birmingham, Ala.	2	Macon, Ga.	4
Butte, Mont.	6	Memphis, Tenn.	2
Chattanooga, Tenn.	2	Mobile, Ala.	2
Chicago, Ill.	1	New Orleans, La.	3
Cincinnati, Ohio	1	New York City, N. Y.	3
Cleveland, Ohio	2	Omaha, Nebr.	2
Columbia, S. C.	4	Philadelphia, Pa.	3
Dallas, Texas	3	Pittsburg, Pa.	2
Denver, Colo.	4	Portland, Oregon	9
Des Moines, Iowa	1	Richmond, Va.	4
Detroit, Mich.	2	Salt Lake City, Utah	6
El Paso, Texas	5	San Antonio, Texas	4



The LUDLOW-SAYLOR WIRE COMPANY St. Louis

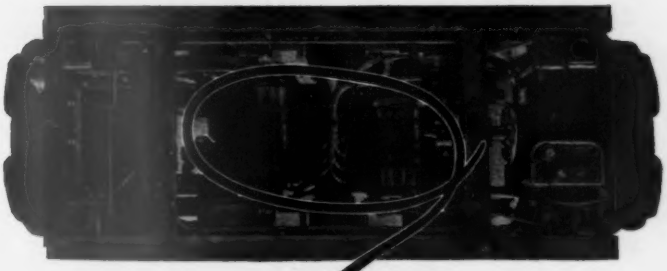
608 South Newstead Ave.

1 — 2 — 3 — 4 — 5

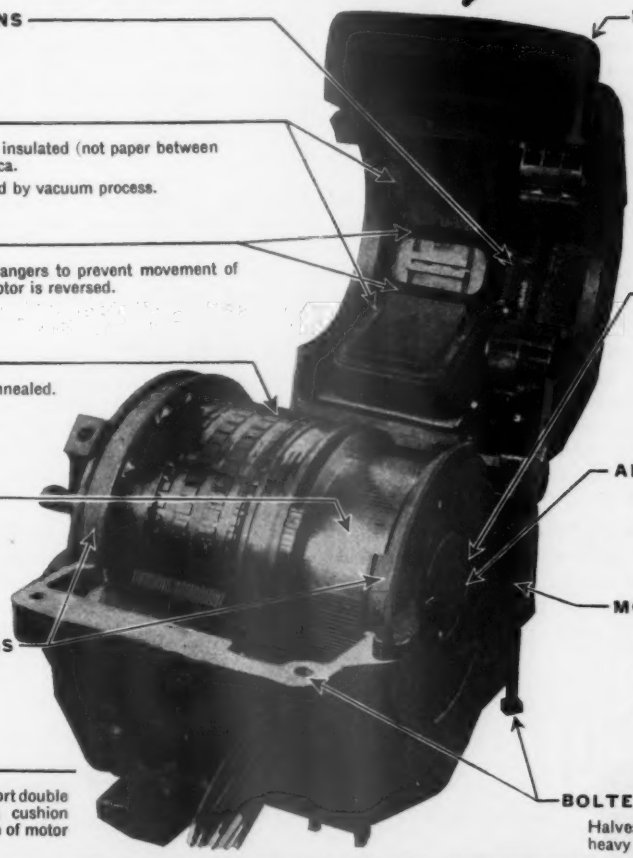
Goodman Locomotives

Save Labor
Save Dollars

Why?



1—Look at the Motors



FIELD CONNECTIONS
All at commutator end.

FIELD COILS
Strap copper, wholly mica insulated (not paper between turns) and wrapped in mica.
Finished coils impregnated by vacuum process.

POLES
Laminated. Brass coil hangers to prevent movement of coils along poles when motor is reversed.

ARMATURE COILS
Strap copper, carefully annealed.

COMMUTATOR
Bolted construction.
Large diameter.
Wide face.

BEARING HOUSINGS
Bolted to motor shell.
Large contact areas.

MOTOR SUPPORT
Third point of motor support double spring mounted, giving cushion action for either direction of motor rotation.

MOTOR SHELL
Cast steel, with large openings for free access to brushes, field coils, etc.
Top half removable without disturbing other parts.
Bottom half hangs on axle.
No pit required.

ARMATURE BEARINGS
Ball bearings of extra large size, with solid ball-retainers and keyed-type lock rings.

ARMATURE SHAFT
Made of forged axle stock, ground to size and removable.

MOTOR SUPPORTS
Bushed axle bearings afford two points of motor support.
Through bolts for motor shell hold axle bearing caps in place.

BOLTED SHELL
Halves of shell held together by heavy through bolts—not cap screws.

EVERY PART MADE BY GOODMAN

(8)

GOODMAN MANUFACTURING COMPANY
4746 to 4854 South Halsted Street
CHICAGO, ILL.

MISSOURI PACIFIC RAILROAD COMPANY

GULF COAST LINES INTERNATIONAL-GREAT NORTHERN

Missouri Pacific Lines Are Building Bigger and Better Communities

ADEQUATE and dependable railroad transportation service always is the determining influence in the location of new industries or the relocation of old ones. Communities grow and develop by the acquisition of new industries. New industries add to the population, increase the potential wealth and purchasing power of any community or section and stabilize the prestige of the community. The Missouri Pacific Lines management stands ready to help any community in this connection.

The territory served by the Missouri Pacific Lines offers superior advantages for industrial development. And the Missouri Pacific has become, in a comparatively short space of time, the dominant railroad of the Middle West and Southwest. With unparalleled facilities for reaching the gateways to the East, the Gulf ports on the south and Mexico and the Pacific Coast points, the Missouri Pacific and allied lines are in a position to offer unequalled and unexcelled advantages to any industry in search of a location.

There is, somewhere on the Missouri Pacific, a desirable site for any industry seeking a location. There is an available site, the right community, accessible power, cheap fuel, available labor supply and adequate and dependable railroad transportation service. And there is available trained and thoroughly posted men, within the Missouri Pacific organization, to aid and assist any industry or the leaders in any community in development of this kind.

The Industrial Development Department of the Missouri Pacific Lines and the officials of Allied Lines have available industrial surveys showing population, transportation facilities, available raw materials, power, fuel and water supply and rates on same, labor supply and housing conditions, tax rates, school and church facilities, highway development and available sites for industries. And the Missouri Pacific experts are prepared to co-operate with all persons interested in industrial development matters.

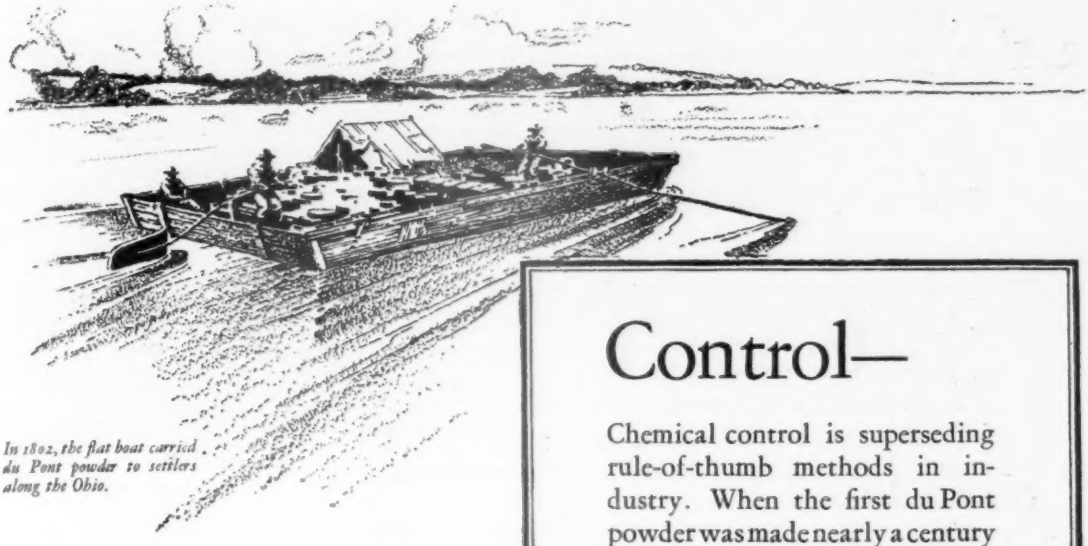
The Missouri Pacific Lines are desirous of being of utmost service to their patrons and the communities served by these lines. There were 508 such new industries established along our lines last year with aggregate capital investments of $41,628,900. The number can be increased this year and the wealth of the communities and territory served by the Missouri Pacific Lines will be correspondingly greater if those interested will permit our organization to co-operate in matters of this kind.

I solicit your co-operation and suggestions.

MISSOURI PACIFIC LINES

President

MAKERS OF POWDERS SINCE 1802



In 1802, the flat boat carried du Pont powder to settlers along the Ohio.

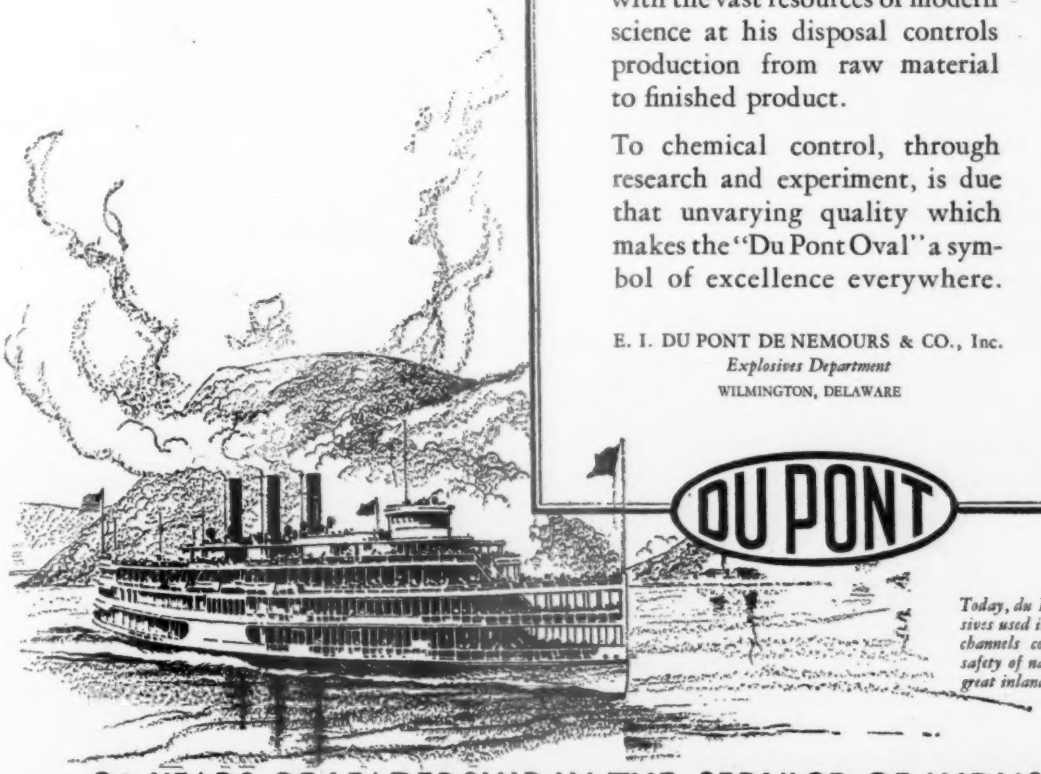
Control—

Chemical control is superseding rule-of-thumb methods in industry. When the first du Pont powder was made nearly a century and a quarter ago—chemistry was not an exact science.

Today, the chemical engineer with the vast resources of modern science at his disposal controls production from raw material to finished product.

To chemical control, through research and experiment, is due that unvarying quality which makes the "Du Pont Oval" a symbol of excellence everywhere.

E. I. DU PONT DE NEMOURS & CO., Inc.
Explosives Department
WILMINGTON, DELAWARE



DU PONT

Today, du Pont high explosives used in deepening river channels contribute to the safety of navigation on our great inland waterways.

123 YEARS OF LEADERSHIP IN THE SERVICE OF INDUSTRY

"Fourteen Points"

ALABAMA:

In commercial parlance Alabama must be recognized as a going concern in that what she produces within her border will feed, clothe and house her people.

Coal, her principal product, was first mined about 1827. The half-million mark in production was touched in 1880, from which time the present great industry really began. An estimate in 1920 puts the available reserves at 66,711,378,260 short tons.

In 1923 Alabama produced 2,797,190 tons of pig iron and 1,850,000 tons of steel. The greater part of the pig iron not used in the manufacture of steel is made into cast-iron pipe, in which industry the Birmingham District is said to lead the world.

The limestones in North Alabama are so widely distributed and of such quality as to insure a practically inexhaustible supply for cement making.

The production of sand and gravel in the state in 1922 was $346,920.

ARKANSAS:

Arkansas is rich in mineral wealth. The mineral industry at the present time, while only partially developed, was valued in 1923 at $61,000,000.

Petroleum is by far the most valuable mineral asset of the state. Coal ranks second with a production in 1922 valued at $4,600,000. The natural gas produced in the same year was 9,700,000,000 cubic feet, with an estimated value of $1,800,000.

Arkansas produced in 1913 495,117 short tons of bauxite, being 94.7 percent of the United States production. Her clay deposits are of sufficient size to make her one of the largest clay-product manufacturing states in the Union.

The only place in North America in which diamonds have been found is in Pike County, Arkansas.

Other minerals of commercial quantity are manganese, chalk, Fuller's earth, novaculties, and building stone.

FLORIDA:

While Florida is a dominant factor in the phosphate rock industry, the state has vast deposits of high-grade clays, Fuller's earth, diatomaceous earth, and tripoli with gypsum, limestone and marls assuming a prominent place in the state's mineral production. The ilmenite and rutile recovery from Duval and neighboring east coast county beach sands has entered into keen competition with the same industry in Virginia and North Carolina.

The great peat beds of Florida found in the Everglades are the scene of experimental plants working out fuel values, producer gas possibilities, and improved fertilizer fillers.

GEORGIA:

Georgia has 41 known mineral products, the principals being clays, sand and gravel, building stone and mineral waters.

The value of barytes output of Georgia now exceeds that of any other state. The entire production is from Bartow county, in the vicinity of Cartersville. Fifty-seven plants are at present operating in this district.

Limestones, shales, and clays suitable for the manufacture of Portland Cement are widely distributed throughout Northwest Georgia. The clay deposits of Georgia are one of its greatest mineral assets. The great thickness and extent of these clay beds and the purity of the clays themselves are probably nowhere duplicated in the country.

Granite suitable for both building and monumental purposes is widely distributed over the Piedmont Plateau.

The value of the output of Georgia marble now exceeds that of any state except Vermont. The stone is widely used for monumental purposes; the statue of Lincoln in the Lincoln Memorial at Washington is made of Georgia marble.

KENTUCKY:

The asphalt industry in Western Kentucky is already firmly established. Coal and clay have for many years constituted the major mineral production. In recent years oil, natural gas, and natural gas gasoline have added substantially to the mineral output, while sand and gravel, and building stone have played an important part.

The oil shale resources of Kentucky are so large as to stagger credibility. A conservative estimate of the available reserves is 90,604,800,000 tons.

LOUISIANA:

The great mineral resources of Louisiana are salt and sulphur, oil and gas, but in addition to these are the asphalt seepages which wash up along the Gulf Coast in Terre Bonne Parish and the gravel and sand from Profitt's Island.

So active is the demand for road binder in Louisiana that pine stump distillation has been actively developed. The charcoal finds a good market, the heavy oil goes into turpentine, and the oil of pine is used in flotation. The waste pitch and tar are then available for road oil, road binder, and as a binder for lignite briquettes.

A new phase of the lime industry is the utilization in Southern Louisiana of the extensive shell deposits on Isle de Coquilles.

MISSISSIPPI:

Mississippi is beginning to awaken to her opportunities as a mineral-producing state.

The chief resources are clays, bauxite, sand and gravel, but there are also vast resources of limestone, building stone, tripolite, Fuller's earth, lignite, mica and phosphate rock, a wide diversity of clays, deposits of ocher, barytes and potential oil resources similar to Louisiana will add to her mineral wealth.

For full information attend Southern Industrial

OF THE SOUTH

NORTH CAROLINA:

North Carolina has the second largest aluminum plant in the world. It ranks first in value and quantity of mica produced in the United States, and its talc brings the highest price of any domestic production.

Of 184 minerals which have been found within the state, 55 are in commercial quantities and quality. Among the principals of these are all the various kaolins and clays, corundum, and natural abrasives, barytes, feldspar, the gem minerals, granite, limestone, marble, and many beautiful building stones of highest grade.

Exclusive of brick and manufactured clay products the mineral production of the state in 1923 exceeded $10,000,000.

OKLAHOMA:

Outstanding in its rapid mineral development, Oklahoma's mineral resources are valued today at $3,035,000,000.

Oklahoma has in known commercial quantities more than 20 valuable mineral products, the principals being petroleum, natural gas, zinc, lead, and coal.

Fifteen counties of Eastern Oklahoma are now producing coal, the average amount mined each year being about 3,000,000 tons. Billions of tons of asphalt are available and of the various building stones Oklahoma possesses inexhaustible quantities.

Oklahoma leads the United States in the amount of undeveloped gypsum and some of the largest deposits of tripoli in the world are located along the Missouri-Oklahoma line in the northeastern part of the state.

SOUTH CAROLINA:

The kaolin deposits around Langley, S. C., are among the best in the United States.

The barytes beds of Cherokee county compare favorably with the best Georgia product. Diatomaceous earth, Fuller's earth, chert, and road building materials and the various brick clays are among the resources of the state, while agricultural and chemical limestones and marl are found in sufficient quantities to make them well worth development. Good sand for concrete purposes is found in Lexington and Beaufort counties.

Soapstone is quarried at numerous points in South Carolina. In McCormick county, near Modoc, is a 600-acre deposit of shale suitable for vitrified brick.

TENNESSEE:

Tennessee has 37 mineral products of commercial quantity and quality. One of the principles of these is barytes. Bauxite is a new refractory which has been recently developed in Hamilton county—the only other places in the world where this product is mined are Austria and Germany.

Chert and road building materials, sand and gravel are among the major resources. Granite, marbles, and building stones of all kinds are found in abundance and wide variety. More marble is shipped from East Tennessee than from any other state.

No description is necessary of the coal resources of Tennessee which are well known, while the copper and zinc industries in the eastern part of the state have been established for many years.

TEXAS:

At the present time the mineral production of Texas has a value in excess of $200,000,000, the principle products being petroleum, natural gas, salt, building stone and clay.

Asphalt occurs in many of the northern counties; gold and graphite are mined in the state, and cinnabar is an active industry in the Chisos Mountains.

In its fuel resources Texas is fortunate in having, in addition to its oil and gas, both coal and lignite, the production of which is valued at between $5,000,000 and $6,000,000 annually.

The principle stone resources include granite, marble, limestone and sandstone, and the clays are widely distributed, being especially desirable for making brick, tile, sewer pipe and stoneware.

VIRGINIA:

Possessed of a great variety of mineral resources, which afford the basis of a varied and extensive mining industry, Virginia ranks as one of the most important mining states in the south.

Opening of the extensive coal fields in Southwest Virginia gives the state rank among the important coal producing states. The first coal mined in the United States was in the Richmond Basin.

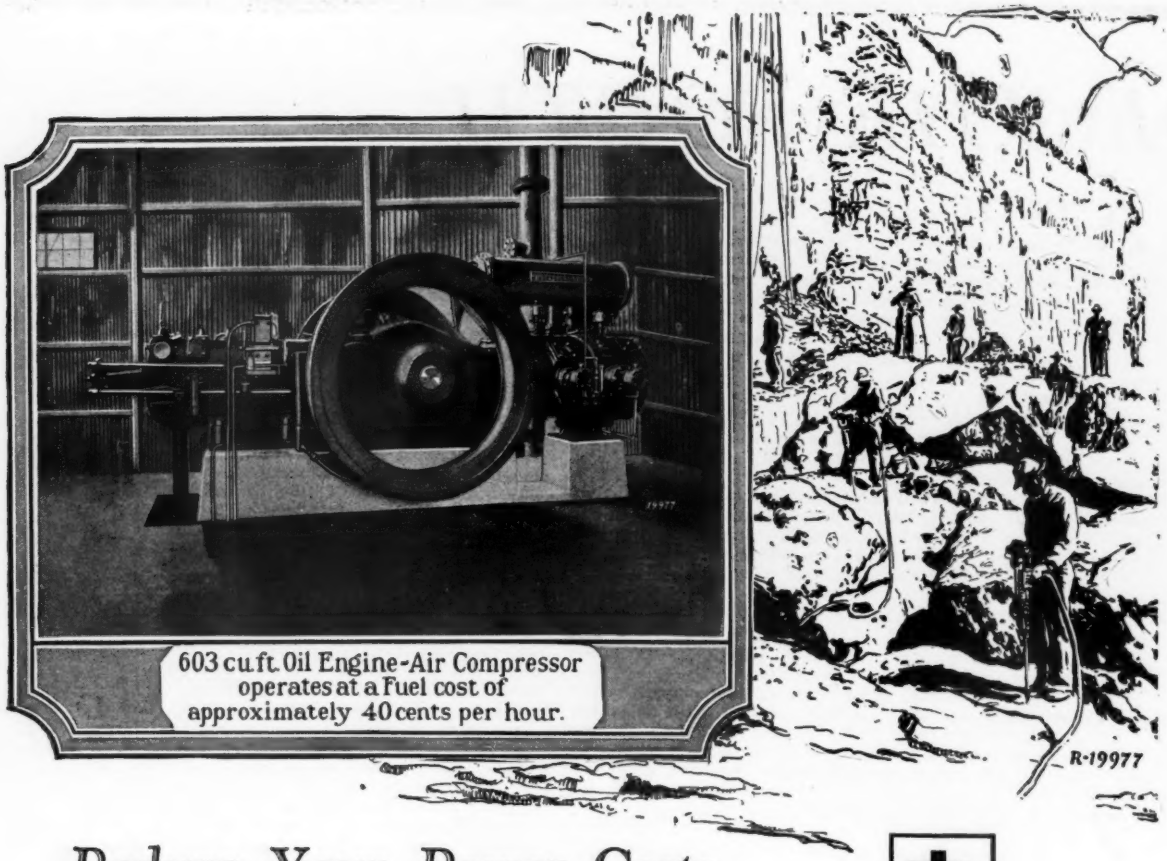
Sands for all uses, especially for building, molding and glass making; Virginia ranks first among the domestic producers in talc and soapstone and the product is shipped to many foreign countries.

WEST VIRGINIA:

West Virginia has more extensive coal deposits of high quality coal than any other of the 48 states. The smokeless coals produced in the state are rated as the highest quality steaming coals in the world. Geologists estimate that there are 1,600,000,000 tons of coal stored in the hills and mountains of West Virginia.

As is well known, West Virginia has long stood first of all the states of the Union in the production of Natural Gas.

Next to coal, probably limestone is the second most valuable mineral resource in the state. Sandstone suitable for building purposes is abundant in nearly every county, while glass sands of finest quality occur in vast quantity.



Reduce Your Power Costs

Your savings in power costs alone (assuming electric power costs 3½ cents per kw. hr.) will pay for this complete Ingersoll-Rand "POC-2" Oil Engine-Air Compressor over a period of 18 months.

But these savings do not end in 18 months. They go on for years—and during these years you have reliable power under your own control, not subject to shut-downs due to outside causes.

271 cu. ft. and 895 cu. ft. sizes are also available.

These Ingersoll-Rand Oil Engine-Air Compressors are rugged and dependable. They *do not* require skilled operators.

Talk this matter over with our engineers. Their experience and counsel are at your service.

Descriptive bulletins sent upon request.

I-R Oil Engines for All Purposes

Ingersoll-Rand ***Oil Engines*** *are of the four-cycle direct-injection type. They burn any fuel oil that can be used in any other Diesel engine.*

The horizontal single-cylinder Type "PO" ***engines*** *are built in 50, 100 and 150 B.H.P. sizes.*

The vertical multi-cylinder Type "PR" ***engines*** *are available in popular sizes from 105 to 1200 B.H.P.*

Detailed information on request.

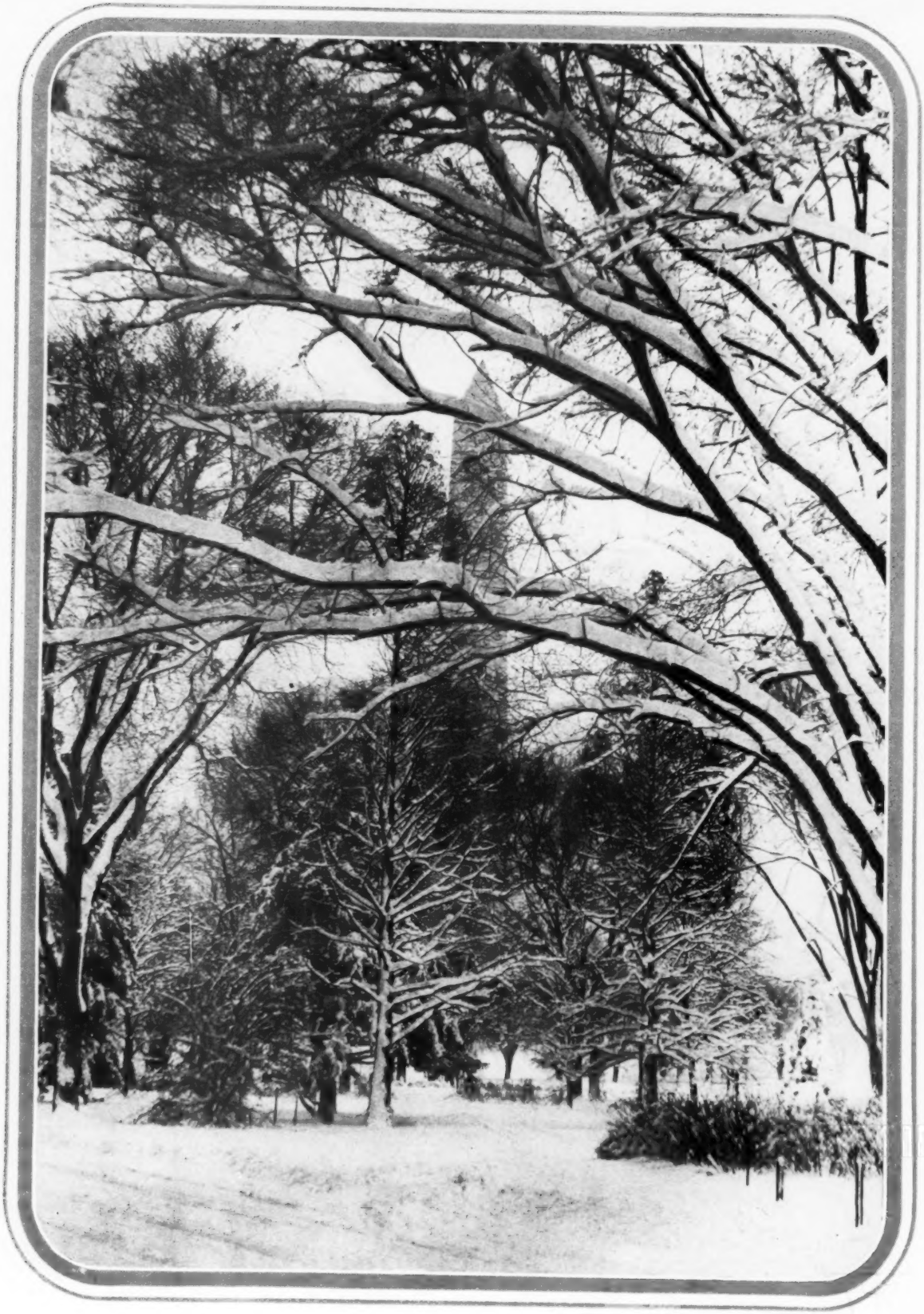
INGERSOLL-RAND COMPANY-11 BROADWAY, NEW YORK CITY.

Offices in principal cities the world over

FOR CANADA REFER-CANADIAN INGERSOLL-RAND CO. LIMITED, 260 ST. JAMES STREET, MONTREAL, QUEBEC.

78-SOE

Ingersoll-Rand



© Harris & Ewing

A late winter snow in Washington

The
MINING CONGRESS JOURNAL

PUBLISHED EACH MONTH BY
Subscription Rate: Per Year, $3.00

THE AMERICAN MINING CONGRESS

MUNSEY BLDG., WASHINGTON, D. C.
Single Copies: $0.30

VOLUME 12 | MARCH, 1926 | NUMBER 3

TAXING THE MINING INDUSTRY

IT is frequently said and generally accepted that the power to tax is the power to destroy. It is somewhat humiliating to the American Mining Congress to admit that after its efforts to secure fair treatment for the mining industry in the matter of Federal taxation and the great advantage which has been brought to the mining industry by virtue of the depletion and discovery clauses of the internal revenue law, that the mining industry is still paying an amount of taxes largely in excess of the proportion paid by any other industry.

There are many who have pretended to believe that the depletion clauses of all of the revenue acts since 1916 gave an undue advantage to the mining industry, and there are some who have pretended to believe that the discovery clause gave the mining industry an unjust and unfair advantage. There have been members of Congress in both the House and the Senate who have assailed these provisions, and a distinguished member of the Ways and Means Committee of the House recently made the statement that the present bill will entirely relieve the mining industry of all tax obligations. We have no doubt that this statement was made with full belief in its truthfulness.

An investigation of the actual facts show conclusively that the mining industry is paying a larger share of taxes in proportion to its ability to pay than any other industry, and from the record there can be no inducement left to engage in the mining business. The development of mineral resources is necessarily filled with hazard. An engineer, who for many years represented a large eastern mining syndicate and who was authorized to secure options upon the most favorable prospects and to spend any reasonable amount of money in their development in order to determine whether his company should buy the property or surrender its option, is authority for the statement that not one in twenty of the prospects carefully selected and properly developed were found good enough after this development to justify the purchase by those whom he represented. This syndicate spent in some instances as much as $100,000 in the development of a single prospect and thereafter surrendered the option because its investigations did not demonstrate that the property was worth the option price to his company.

Table Showing Summary of Gross Receipts, Net Profits, Taxes Paid and Percentages of Same for all Corporations by Industrial Divisions for Year 1923
Industrial Divisions are Shown in the Order of their Percentage to Net Income of Total Taxes Paid

Industrial Division	Gross Receipts	Total Profits Before Taxes Paid	Percent of Profits To Gross Receipts	All Taxes Other Than Federal Income	Federal Income Tax	Total Taxes Paid	Percent of Other Than Income Tax To Profits	Percent of Federal Income Tax to Profits	Percent of Total Taxes to Profits	Net Profits After Deducting All Taxes	Percent of Net Profits to Gross Receipts After Total Taxes Paid
Mining and Quarrying..	$4,876,767,550	$ 139,447,912	2.86	$99,258,420	$30,777,039	$130,035,459	71.18	22.07	93.25	$ 9,412,453	.19
Agriculture and related industries	774,423,891	65,488,295	8.45	19,133,271	9,790,743	28,924,014	29.20	15.00	44.20	36,514,281	4.72
Rubber and rubber goods	1,079,780,739	40,483,293	3.75	14,606,350	2,839,675	17,446,025	36.08	7.02	43.10	23,037,268	2.13
Leather and leather products	1,598,608,120	49,010,404	3.08	9,982,565	8,247,672	18,230,237	20.37	16.83	37.20	30,780,167	1.92
Public service, professional, amusements, hotels, etc.	2,420,815,295	184,929,163	7.64	44,763,787	20,376,829	65,140,616	24.21	11.02	35.23	119,788,547	4.95
Transportation and other public utilities	10,560,622,724	1,895,431,923	17.95	474,124,066	150,998,913	625,122,979	25.02	7.96	32.98	1,270,308,944	12.03
Finance, banking, insurance, etc.	8,752,174,665	1,296,464,539	14.82	322,297,327	95,114,379	417,411,706	24.86	7.34	32.20	879,052,833	10.04
Combinations of industries not ascertainable	800,620,301	60,119,141	7.50	11,239,777	5,209,962	16,449,737	18.70	8.66	27.36	43,669,404	5.45
Food products, beverages, and tobacco	10,085,841,519	490,375,027	4.86	72,103,984	55,646,300	127,750,284	14.70	11.34	26.04	362,624,743	3.60
Paper, pulp and products	1,445,827,777	117,936,925	8.15	17,892,023	12,232,699	30,124,722	15.17	10.37	25.54	87,812,203	6.07
Construcution	2,226,569,284	88,899,466	4.00	11,000,848	11,438,833	22,439,681	12.38	12.86	25.24	66,459,785	2.99
Trade	32,299,071,061	1,134,667,194	3.51	152,012,085	128,536,444	280,548,529	13.40	11.33	24.73	854,118,665	2.64
Lumber and wood products	2,977,317,109	316,822,497	10.63	38,056,020	33,457,215	71,513,235	12.01	10.56	22.57	245,309,262	8.24
Textiles and textile products	7,869,734,405	574,849,007	7.30	62,942,103	65,435,092	128,377,112	10.95	11.38	22.33	446,471,895	5.67
Metals and metal products	16,633,264,555	1,477,828,375	8.89	165,317,527	160,770,716	326,088,243	11.19	10.88	22.07	1,151,740,132	6.92
Chemicals and allied products	6,121,372,554	508,514,021	8.30	55,447,815	49,426,378	104,874,188	10.90	9.72	20.62	403,639,833	6.59
Misc. mfg. industries...	5,141,792,969	474,640,186	9.23	40,682,774	55,265,523	95,948,297	8.57	11.64	20.21	378,691,889	7.37
Printing and publishing	1,988,459,435	165,207,772	8.31	12,924,646	19,428,960	32,353,596	7.82	11.76	19.58	132,854,176	6.68
Stone, clay and glass...	1,366,800,359	189,431,362	13.87	11,244,801	22,113,441	33,358,242	5.93	11.68	17.61	156,073,120	11.42

Data from pages 13, 14 and 15 of "Statistics of Income From the Returns of Net Income for 1923." Included in the net profits are tax-exempt interest and dividends received on capital stock of corporations. Net losses of previous years are not included as it is desirable to have the actual net profits for the year 1923 shown.

The many thousands of dry holes in oil prospecting, the many thousands of idle tunnels and shafts which decorate metal mining regions of the West are conclusive proof of the hazardous character of these enterprises. The great majority of these disastrous developments are not reported to the Internal Revenue Bureau in Washington. Only those companies report which either have made a profit or who might have been supposed to make a profit and, therefore, required to make a tax return.

The MINING CONGRESS JOURNAL is startled to know the exact facts with relation to the profits earned by those companies which have made tax returns to the Internal Revenue Bureau of the Federal Government. We append a table showing the salient facts with reference to the returns for the year 1923. This table shows that the mining and quarrying industry, which includes oil and coal, paid in state and Federal taxes 93.25 percent of its total net profits. It shows that after having paid its taxes there remained a net profit of nineteen hundredths of 1 percent of its gross receipts as a profit, while the agricultural and related industries show a net profit of 4.72 percent, transportation a net profit of 12.03 percent, finance, banking, and insurance a net profit of 10.04 percent. This table shows that the leather and leather products business, with the lowest profit next to mining, earned a profit of 1.92 percent of its total gross receipts; and yet the net profit of this industry was a little more than ten times as great as the profits of mining, while the transportation industry earned a profit proportionately sixty-three times greater than mining. The mining industry furnishes more than half the total freight tonnage handled by the railroads and pays transportation rates which enables the transportation industry to earn a profit sixty-three times greater and always asking for more.

In the percentages of these taxes paid to the Federal Government, the mining industry still stands at the head with a percentage of 22.07 percent, which is approximately twice as great as the average of other branches of industry. In taxation to the state governments from its net profits 71.18 percent is paid, and yet in the face of this startling condition there are those who believe the mining industry has been escaping its share of public support.

While the MINING CONGRESS JOURNAL is greatly pleased with the outcome of the present legislative action in the framing of the new revenue act, at the same time we submit that the bill lacks much of doing justice to the mining industry and that in all of the states the mining industry is entitled to more careful consideration by state legislative bodies; and we further submit that since mining is an industry which carries so much of hazard, and which develops so much of new taxable property, the state and Federal legislative bodies should look last to the mining industry for increased revenues rather than compel it to be the first called upon to defend itself against an increase of tax burdens.

HANDS OFF TRANSPORTATION

WITH the tax bill out of the way, it will be possible for both the House and Senate to give some consideration to transportation matters. The Hoch-Smith law, under which the Interstate Commerce Commission is making a more or less meaningless gesture in attempting to carry out the rate investigation for which no appropriation and no administrative machinery was provided, is still on the statute books.

Most of the reasons which were given as justification for the passage of this law no longer exist. It is, therefore, obviously a mistake to expect any helpful results, for by the time the testimony that has been, is being, and is to be taken by the Commission can be analyzed and conclusions reached, a new set of conditions will exist, just as conditions at present differ from those which prevailed when the Hoch-Smith law was passed.

Some other measures are pending which should have most careful consideration before they are pressed for passage. Measures proposed two or three years ago may not be appropriate at all to meet conditions that exist today. This observation probably is applicable to every transportation amendment now pending.

The Interstate Commerce Commission has a gigantic task to perform in hearing and deciding disputes between shippers and carriers without having imposed upon it additional duties and responsibilities that have no clearly defined object to obtain and no certain results to achieve. For that reason, Congress would do well to consider the immediate repeal of the Hoch-Smith law and to adopt for the present the policy of leaving the Commission, the railroads, and the shippers alone to work out existing transportation problems.

THE FARMER AND THE TARIFF

AT the present time there is much discussion as to whether the farmer is benefited by the tariff or whether because of the theory that many of the articles which he must use are more expensive creates a condition in which the tariff is a burden upon the farmer.

The farmers of the United States have been the bulwark of protective tariff principles. In the main, it has been the prosperous farming states which have furnished the bulk of the support which has upheld the protective tariff. The prosperous farmer and the prosperous country have gone hand in hand, and this has been true when there was no effort to provide tariff duties as against the importation of agricultural products.

What the farmer needs is a profitable market in which to dispose of his products. His goods are mainly perishable. Long distance transportation is not only expensive but the cost of preserving his products, by refrigeration or otherwise, until they reach the market so adds to his cost that the farmer's return, even from a high price to the consumer, is not profitable. A near-by home market able to consume his entire output is the greatest boon which the farmer can have.

The extent that the tariff develops home manufactures and creates a home market for the farmer's output is the measure of the benefit of the tariff to the farmer. The value of farm land depends upon its proximity to the centers of consumption. Centers of consumption can not exist without earning power. Earning power in manufacturing centers is based upon ability to take raw material at a low price and through its fabrication make it command a higher market price. If farm lands near a large city supported by manufacturing interests are of higher value than those located at a distance from such cities, this difference in value is one of the measures of the value of the protective tariff to the farmer.

KAISER BILL AND CZAR LEWIS

THERE is no force so great that it can continuously override the principles of justice which are the ruling force of every civilized people. This statement is equally true as applied to separate groups within an individual nation or to an individual nation as it relates to the other governments of the world.

Kaiser Wilhelm made a bitter, a brutal, a devastating effort to make himself and his country the ruling force of the world. He accomplished the most colossal failure in the history of the world. He not only lost that which he sought but also his supremacy in his own government, becoming an outcast and an exile, but brought ruination to his country.

John L. Lewis has made a bitter, a brutal, and a long-continued fight to make himself and his organization a dictator in a great fundamental industry, the production of which was essential to the prosperity of the nation. He has failed to accomplish any of the things for which he fought. His principal contentions in the anthracite strike were, first, an increase in wages; second, the check-off; and third, the right to strike as the only method by which labor disputes could be determined. He did not get the increase in wages, he did not get the check-off, he surrendered the right to strike and took in its place a binding agreement to arbitrate such differences as shall arise in the future. What did he accomplish to justify the great hardships to his followers?

He still has the Jacksonville wage agreement, but no work for those for whose benefit it was demanded. He has been responsible for an enormous increase in production capacity in the bituminous coal fields—which were already overdeveloped—which has added very greatly to the real troubles in the coal industry. Good wages can be earned only in a prosperous industry. The bituminous industry can not be prosperous so long as its lot is idleness for one-third of its equipment all the time or for all of its equipment one-third of the time.

If Mr. Lewis would devote his power to a solution of this problem of making the industry profitable for all—for operator, miner, and consumer—he would be working with those forces which make for the benefit of all.

The anthracite strike has been very costly to the public, but this cost will be fully justified if it has brought us a little nearer to the point where disputes which affect the public interest, which can not be settled by mutual agreement, shall be determined by arbitration, either voluntarily or compulsory. In nearly every walk of life, he who has a grievance must seek redress in the courts. Every attempt to obtain redress except by mutual agreement or by appeal to the courts becomes an infraction of law which it is the duty of the state to prevent.

Determination of disputes between individuals at law rather than by force is the outstanding difference between barbarism and civilization. No government can survive which fails to provide substantial protection for the rights of individual citizens. The foundaton of individual liberty is based on the tacit agreement of every citizen to obey the laws of his country. A positive agreement to submit future anthracite industrial disputes to a board of arbitration, coupled with a definite plan for the selection of that board, is a substantial and gratifying step toward industrial peace.

If Mr. Lewis shall also have learned that defeat is the ultimate end of all who undertake to enforce uneconomic conditions, then the anthracite strike will not have been in vain.

FACT-FINDING COMMITTEES

THE action of Congress in creating a joint congressional committee to study and report on the internal-revenue taxes and their administration is a constructive step. It will meet with public approval because taxpayers will not be excluded from its hearings, and its investigations will be devoted to seeking improvements rather than faults.

The administrative system has worked well, considering the size of the task and the involved procedure that has had to be invoked; but experience has demonstrated the need for improvement in relation to some phases of the tax administration. The establishment of this joint committee, therefore, is a definite move toward further simplification of the law, and further improvements in administrative organization and procedure.

It is intended that this committee shall gather information from taxpayers as well as from the revenue department of the Government; that taxpayers' views shall have due consideration; and that proposed measures growing out of the investigation shall be published from time to time for public examination. This is in contrast to some previous investigations that were notorious for the wild charges, baseless assertions, and unsupported rumors that were passed on to the public without proper investigation and analysis.

This joint committee will make findings and recommendations which will be published at the proper time, so that taxpayers will have sufficient opportunity to support proposals that are meritorious and to oppose measures that may be ill-advised and injurious.

The members of the joint committee undoubtedly will be guided in their policies to large extent by their respective committees to which they are responsible. They will be carefully selected by their committees, and the public may look forward to a well-planned, constructive investigation, that will not disturb the morale of the revenue employes or cast unjustifiable reflection or suspicion upon taxpayers merely for purposes of publicity and notoriety for the investigators. In other words, this committee will be a fact-finding body and not a secret inquisition.

Congress would do well to follow this plan in relation to other proposed investigations in order to insure impartiality, intelligence, and efficiency in dealing with the problems that may be disclosed. Both the House and Senate have enough regular committees to which proposed investigations can be referred, and from which competent subcommittees and joint committees can be selected, so that there should be no necessity for ever again creating a speeial investigating committee, having no fixed responsibility or check upon it, to go on a wild rampage after scandal, and wind up with no findings of fact or recommendations that can be relied upon.

INDUSTRIAL DEVELOPMENT OF THE SOUTH

THE southeast quarter of the United States has resources that could make it entirely independent of the world, for besides its great agricultural capacity this territory contains in commercial quantities some eighty-three minerals, all in high-grade quality.

The Southern Industrial Development Conference, which is to be held under the auspices of the American Mining Congress at Memphis, Tenn., March 15, 16, 17, offers an unusual opportunity to bring before the nation the South's great potential wealth.

Never before has there been afforded such an opportunity for producer and consumer, shipper and manufacturer, engineer and chemist, investor and industrial

agent, to meet under the same roof and to make effective their common interest, the development of new industries in the South.

The enthusiastic response from the governors of the Southern States, chambers of commerce, and business men generally to the call for this conference leaves little doubt as to its success.

The program is in keeping with the importance of the meeting. Speakers of national importance will discuss possibilities for southern development; transportation problems, taxation, power in industry, labor conditions, the tariff, government in business and financing industrial enterprises.

Every effort will be made to acquaint those in attendance with southern opportunity, and to bring to the attention of capital the vast mineral resources which abound in the South.

The conference will redound to the permanent good of the South, and it is hoped will open the way to permanent development of these virgin resources.

THE BIG QUESTION

NOW that it is all over, the big questions become: What does the settlement of the anthracite strike mean to the anthracite miners and operators; to the coal industry and to the country?

Before those interpretative questions can be answered, the outstanding terms of the settlement must be stated. It was not, as such things usually are, a verbose agreement. It went quickly and directly into points at issue and stated bluntly what had been agreed upon. Somebody drew that document who knew how to say what everybody wanted said. Thus, if a thing was optional and of relatively little consequence, the mild and spineless word "may" was used. But when it was desired to put in punch and when there was to be no question, they used the bristling and imperative word "shall." That is always a mandatory word when found in statute or a contract. This is a contract.

While the contract is neither wordy nor does it cover too many points, it does go into details which compel you to dig for the main points. There are two main points in this contract. One is for a possible annual revision of wages. Here is where the soft and persuasive word "may" comes in. Either party "may" ask for a change of scale "after" each first of January. The other is for a "reciprocal program of cooperation and efficiency." In this matter, the imperative word "shall" is used.

That nice little distinction—just the change of a small verb—is clearly the essence of the contract. But while on this subject of distinction, another is vitally important, or will be before this contract is a year old. The document ambles pleasantly—sort of saunters—into the possibility of a wage change by saying that either party "may" propose such a thing. It leaves that door open, extending a smiling welcome. Nobody is pushing toward it; there is no coercion. It is just an invitation in good fellowship. But, let either side step over that cheery threshold and he finds himself in the clutches of machinery as ruthless as a steel corset. From that moment, the old, soft "may" is left behind and action is prodded forward at the bayonet point of the word shall—Thus!

The operators and miners "*shall*" each nominate three men. Of these, the miners "*shall*" select one named by the operators; the latter "*shall*" select one named by the miners. Then the board of arbitration "*shall*" be organized.

These arbitrators "may" select a third member. But, whether they do so or not, the board "shall" make a report in 90 days which "shall" be binding on both parties.

Also, before such a board is assembled, the operators and miners "may" agree. But, if within 30 days *after request* for a change, they have not agreed, *the matters* remaining in dispute "shall" go to the above-mentioned board.

Mr. Lewis after signing that contract took the wide world into his confidence to say that he had not agreed to "arbitration." He may believe he can avoid it by not, himself, asking for a change of scale. But he is not the only one who can ask; the operators have the same privilege. The instant they exercise it, the whole irresistable machinery of arbitration is in operation with a decision *no more than* 120 days away, 30 days for an agreement and 90 days for arbitration. Mr. Lewis may *say* that this is an innocent plaything; to one who understands English words it looks far more like a grist mill.

Then there steps in that crisp, cold provision about a "reciprocal program of cooperation and efficiency." A true genius drew that provision. It is as amiable as a convivial judge—and just as stern as the same judge when he puts on the black cap. It starts with a nice friendly word "reciprocal." It fairly gallops toward amity with another soft (almost mushy) word "cooperation." It makes you think of the heavenly twins in loving embrace. Then it steps on the gas and says the conciliation board "shall" suggest such a program.

If you squint at those two pronouns standing side by side, you get an entirely new conception of this contract. Either side "may" ask a change of contract—neither is obliged to ask it; may not want to. But *both* sides *must* conform to the program of cooperation and *efficiency* which the conciliation board "shall" prescribe. To a man up a tree, it looks as though the main hope were in the program. But, if either side fails in performance, the door is open to the other to ask for a change of contract and to *force arbitration* of the disputed points.

The days of shirking and puttering in the anthracite industry seem to be at an end. If they continue, the arbitrators will deal with those who refuse to be governed by the program of efficiency. This is a contract which was born with teeth.

OPENING THE DOOR

WITH the anthracite contract in force for four and a half years, he would be a rank pessimist who would say that it would have no effect upon the coal industry as a whole. It is quite evident that the provisions of the contract open the door wide for one of the most sweeping changes that has ever taken place in the bituminous industry.

For instance, there is the old and familiar conciliation board—never employed in bituminous for some mysterious reason—suddenly come to life with a new and life-saving purpose. It is an outside agency. It is now assigned the task of prescribing a program of cooperation and efficiency. In the bituminous field, such a program—on the score of efficiency alone—might easily and quickly dissolve the whole dispute over the use of loading machines and other vital issues.

Born September 4, 1872 *Died February 8, 1926*

Colonel Daniel B. Wentz, Late President of the American Mining Congress

SOUTHERN INDUSTRIAL DEVELOPMENT CONFERENCE

Meeting Under Auspices Southern Division Of The American Mining Congress To Be Held At Memphis, Tenn., March 15, 16, 17, To Be Epoch In Southern Development History—Splendid Program Arranged—Large Attendance Assured

PLANS for the Southern Industrial Development Conference to be held under the auspices of the Southern Division of the American Mining Congress at Memphis, Tenn., March 15, 16, and 17, have received the wholehearted endorsement and support of the Governors of the Southern States, Chambers of Commerce and leading business men of the South.

The Southern Division was created five years ago, having for its purpose the building up and development of the South's mineral resources. This division functions through a Board of Governors of which William H. Lindsey, President, Napier Iron Works, Nashville, Tenn., is Chairman.

The following gentlemen are members of the board: J. B. McClary, Yolande Coal & Coke Co., Birmingham, Ala.; Percy D. Berry, Providence Coal Mining Co., Providence, Ky.; Lee Long, Clinchfield Coal Corporation, Dante, Va.; E. L. Hertzog, Cherokee Mining Co., Spartanburg, S. C.; W. S. Peebles, Paga Mining Co., Cartersville, Ga.; S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.; H. B. Flowers, New Orleans Public Service, Inc., New Orleans, La.; C. J. Griffith, Arkansas Central Power Co., Little Rock, Ark.; Dr. Joseph Hyde Pratt, Biltmore Forest, Biltmore, N. C.; W. H. Smith, Chamber of Commerce, Laurel, Miss.; C. G. Memminger (Florida), Coronet Phosphate Co., Asheville, N. C.

Three years ago the American Mining Congress through the Southern Division employed Dr. Henry Mace Payne, nationally known consulting mining engineer, to make an exhaustive economic survey of Southern Mineral Resources. The survey has now been completed and furnishes the basis for this Industrial Development Conference. This survey brought to light the interesting fact that in this Southern Mineral Empire there exists both in quality and quantity 83 valuable minerals that have been practically undeveloped.

With Southern mineral reserves of almost unlimited extent available for development and with outside fields possessed of a surplus of wealth looking for investment it is believed that this conference will be highly significant in creating new industries for the South, employing capital profitably and in establishing permanent industries that will employ thousands of workingmen.

The southeastern quarter of the United States is rich in deposits of kaolin, and other clays, mica, talc, oil shale, gypsum, slate, cinnabar, fluorspar, bauxite, ochre, barytes, bentonite, manganese, rutile and ilmenite—minerals with which the general public is unfamiliar but upon which rests much of the economic importance and safety of the United States. Each named mineral is a potential industry lying either asleep or but half awake awaiting capital and machinery to transform it into the industrial giant it will inevitably become.

The production of all of these minerals is surrounded by a large number of problems, economic, financial, and mechanical. Practically each of them is dependent upon a protective tariff for their existence as a self-sustaining industry. Some of them are protected adequately or inadequately through the present tariff law. Recognizing the problems that must be met in the development of this vast mineral empire, the Southern Development Conference has arranged a program of outstanding importance which will cover the situation from the protective tariff to practical operating problems, from the question of public vs. private operation of industry to the financing of industrial enterprises.

W. H. Lindsey, Chairman, Board of Governors, Southern Division

The announcements of the meeting have declared that "This meeting will be the clearing house on information of Southern Resources, it will form a point of contact between producer and consumer, and will pave the way for an intimate association between investment capital and dormant resources." Among the speakers announced by the program committee will be national leaders of industry, bankers interested in the financing of industrial development, railroad executives whose activities are devoted to the expansion of their lines to adequately handle the rapidly increasing traffic; contractors and builders, representatives of the brick industry, the sand, gravel and cement industries, owners of undeveloped raw materials, and manufacturers of equipment which is designed to assist in the development of these mineral deposits safely, efficiently and economically.

The Memphis Chamber of Commerce has cooperated with the American Mining Congress in arranging for this conference which will be held in the beautiful Hotel Peabody at Memphis, and in sending the official call for the meeting to a large list of southern business men, said:

"The Southern Industrial Development Conference, which is to be held at the Hotel Peabody, Memphis, Tenn., March 15, 16 and 17, under the auspices of the American Mining Congress, offers a great opportunity for the development of the South's great mineral resources. Every Southern state possesses in commercial quantities almost undreamed of quantities of mineral wealth. With very few exceptions, all of the minerals known to science are found in the Southern States, and found in unusually large quantities.

"The Conference at Memphis was arranged through the American Mining Congress for the purpose of bringing together every element which has to do with the marketing of mineral resources. We do not hesitate to say that this conference may be expected to result in the location of numerous industries in the various Southern States.

"When we consider mineral resources we usually think of metallic ores, like gold, silver, copper and iron. These are present in the Southern States, but represent only (*Continued on page* 196)

Program for

THE MEETING OF THE SOUTHERN DIVISION OF THE AMERICAN MINING CONGRESS

MEMPHIS, TENN., MARCH 15, 16, 17, 1926

First General Session

MONDAY MORNING, March 15th

Chairman—WM. H. LINDSEY, Chairman, Board of Governors, Southern Division.

Address of Welcome by Mayor PAINE, of Memphis.

Subject—**"Opportunities in Southern Mineral Development"**

Brief responses from representatives of each of the 13 Southern States:

Va.	HON. WILBUR A. NELSON, State Geologist, Charlottesville
W. Va.	(To be announced later)
N. C.	HON. BRENT S. DRANE, State Geologist, Charlotte
S. C.	E. L. HERTZOG, Mine Operator, Spartanburg
Ga.	J. M. MALLORY, General Industrial Agent, Central of Ga. Ry., Savannah
Fla.	HON. HERMAN GUNTER, State Geologist, Tallahassee
Ky.	JOS. E. JOHNSON DR. HUGH D. MISER, State Geologist, Nashville
Ala.	(To be announced later)
Miss.	L. J. FOLSE, Managing Director, Mississippi Development Board, Jackson
Ark.	HON. J. H. HAND, White River Chamber of Commerce, Yellville
La.	DR. W. K. IRIONS, Director, Dept. of Conservation, New Orleans
Texas	(To be announced later)

Second General Session

MONDAY AFTERNOON, March 15th

Chairman—C. G. MEMMINGER, Member Board of Governors, Southern Division, for Florida

Subject—**(a) "Southern Mineral Tariffs"**

Message from RICHARD H. EDMONDS, Editor, Manufacturers Record

Thirty minute discussion

(b) "Neglected Issues in Labor Relations"

"Insurance and Employers' Liability"—HENRY S. IVES, Casualty Clearing House, Chicago.

"The Application of Industrial Cooperation to the South"—J. G. BRADLEY, former President Nat'l Coal Asso.

"The Southern Division of the American Mining Congress, Its Work and Aims"—J. F. CALLBREATH, National Secretary

Third General Session

MONDAY EVENING, March 15th

Chairman—S. J. BALLINGER, Member, Board of Governors, Southern Division, for Texas

Subject—**"Power in Industry"**

Address:

M. H. AYLESWORTH, Managing Director, National Electric Light Association

P. S. AWKRIGHT, Pres., Ga. Light & Power Co.

Fourth General Session

TUESDAY MORNING, March 16th

Chairman—W. H. SMITH, Member, Board of Governors, Southern Division, for Mississippi

Subject—**(a) "Public vs. Private Operation of Industry"**

Address:

J. W. COWPER, Associated General Contractors, Buffalo, N. Y.

HENRY M. PAYNE, Consulting Engineer, American Mining Congress, Washington

(b) "The Epidemic of Legislation"

Paper written by HON. PETER O. KNIGHT, Tampa, Fla.

Fifth General Session

TUESDAY AFTERNOON, March 16th

Chairman—PERCY D. BERRY, Member, Board of Governors, Southern Division, for Kentucky

Subject—**"The Influence of Railroads in Developing Industrial Centers"**

"Practical Operating Problems"

(a) "Need for Established Standards of Preparation"

RAYMOND B. LADOO, Cons. Engr., U. S. Bureau of Mines, N. Y.

(b) "Developments in Electric Smelting"

JAMES A. BARR, Mt. Pleasant, Tenn.

(c) "Southern Industry"

W. G. SIRRINE, Greenville, S. C.

(d) "The Farmer and Texas Potash"

DR. FRANK L. HESS, U. S. Bureau of Mines, Washington

TUESDAY EVENING, March 16th

Banquet

Toastmaster—HERBERT WILSON SMITH, Union Carbide Co., New York

Subjects and speakers to be announced

Sixth General Session

WEDNESDAY MORNING, March 17th

Chairman—LEE LONG, Member Board of Governors, Southern Division, for Virginia

Subject—**(a) "Financing Industrial Development"**

Speaker to be announced later

(b) "Taxation"

(1) "Retarding Mineral Development by Erratic Taxation"

HON. R. A. DOUGHTON, State Revenue Commissioner and former Governor of North Carolina, Raleigh, N. C.

(2) "The Severance Tax as an 'In Lieu' Tax"

HON. GEO. VAUGHAN, Pres. Nat'l Tax Assn., Little Rock, Ark.

Report of Resolutions Committee

Bird's eye view of the mine and mills of Southern Gypsum Co., Inc., at North Holston, Va.

GYPSUM AND THE GYPSUM INDUSTRY

Most Of The Gypsum Produced Is Used In The Cement And Agricultural Industries, But New Uses Are Increasing Rapidly—Methods Of Preparation For Varied Industries Described—Economic Limit In Production Seen

By FRANK A. WILDER *

GYPSUM mined in the United States has increased from 90,000 tons in 1885 to over 5,000,000 tons in 1925. During the same period the amount of gypsum imported from Nova Scotia increased steadily until, in 1925, it was equal to about one-tenth of the domestic production. Excepting for the years when America was involved in the World War and building was restricted by Government edict, the growth of the industry has been steady, as is shown by the following figures:

GYPSUM MINED IN THE UNITED STATES

	Tons
1885	90,405
1892	182,995
1895	265,503
1900	594,463
1905	1,043,202
1910	2,379,057
1915	2,447,611
1920	3,130,305
1924	5,042,629
1925 (estimated)	5,300,000

The growth of the gypsum industry is due to two factors. The development of the Portland cement industry has stimulated the demand for crude gypsum, which is used as retarder in cement. A million tons of gypsum was used for this purpose in 1925. Calcined gypsum has a number of properties that are recognized as exceedingly valuable in modern building construction. It sets quickly, which is often desirable, yet its setting time can be easily controlled, or lengthened, so that it can be satisfactorily manipulated under a great variety of conditions. It has ample tensile and compressive strength, and its plasticity, even when heavily sanded, makes gypsum mortars work easily under the trowel.

In America gypsum was first appreciated as a valuable aid to agriculture. The amount consumed today on the farm is relatively small, hardly more than 100,000 tons, if the gypsum in acid phosphate, created by chemical action during the treatment of raw phosphate, is left out of the count. The place for gypsum in any plan for permanent soil improvement is an important one, and in recent years it is receiving more recognition. This recognition would be more general were it not for the gypsum present in acid phosphate. Concentrated phosphates that contain no gypsum are being put on the market in increasing quantities, and as the tonnage of such fertilizers increases the field for agricultural gypsum broadens. Sulphate sulphur is an essential plant food, in which many soils are decidedly deficient. The proper recognition of its importance as a preservative of the ammonia in barnyard manures will result in an increase in the demand for ground gypsum for farm use. As a corrective for black alkali which is a serious hindrance to agriculture in many western states, it has no equal.

The distribution of gypsum beds in the United States makes possible the use of gypsum products at every point in the country without the penalty of excessive freight charges. East of the Mississippi gypsum in commercial quantities is found in New York, Ohio, Michigan, Iowa and Virginia. West of the river gypsum deposits have been developed in Kansas, Oklahoma, Texas, New Mexico, South Dakota, Montana, Utah, Wyoming, Colorado, Arizona, California, Nevada, and Oregon. The eastern seaboard is supplied from deposits in Nova Scotia, and two cities on the Pacific coast are receiving cargoes of gypsum from quarries on San Marcos Island in the Gulf of California.

Many gypsum deposits are of sedimentary origin. The frequent association of gypsum with salt and other substances found in sea water has led to the belief that it was precipitated from sea water by evaporation. Deposits so found were often disseminated and were later concentrated by the movement of ground water. In some instances commercial deposits of gypsum have been formed by the action of sulphurous waters on limestones.

In preparing gypsum for the market, it is either mined or quarried. Except in the arid regions of the West, quarry operations are usually attended by stripping. In the Fort Dodge, Iowa, gypsum field, the mineral was won by quarrying at favorable points where stripping was light, for 30 years. About 1900 quarrying was abandoned and shafts were sunk through the glacial drift of the gypsum bed, and much gypsum was left in the mines as roof and pillars. Last year in one of the extensive operations at that point, stripping by highly modern methods was resumed, 40 feet or more of over-burden being removed to secure some 20 feet of mineral.

Gypsum is relatively soft and friable and blasting is done with a lower explosive than is employed in winning limestone. In the crushing plants there is a great variety of equipment. Jaw crushers, gyratories and rolls are all used as primary breakers, and there are zealous advocates for each type of machine. Pot crushers or rolls are employed for secondary crushing, the mineral being reduced to pass a two or three inch ring in this operation. In this form it is often shipped to cement mills though in some instances it is still further sized and the fines removed.

For calcining in rotaries the material is taken from the secondary crusher without further (*Continued on page* 173)

* North Holston, Va.

HIGH GRADE CLAYS OF THE SOUTHEASTERN STATES*

A Description Of Clays Found In Southern States Which Yield Seventy-One Percent Of High-Grade Clays Produced In United States—Forty-Two Companies Actively Producing, With More Than Two Hundred And Fifty Promising Prospects Known To Exist

By W. M. WEIGEL†

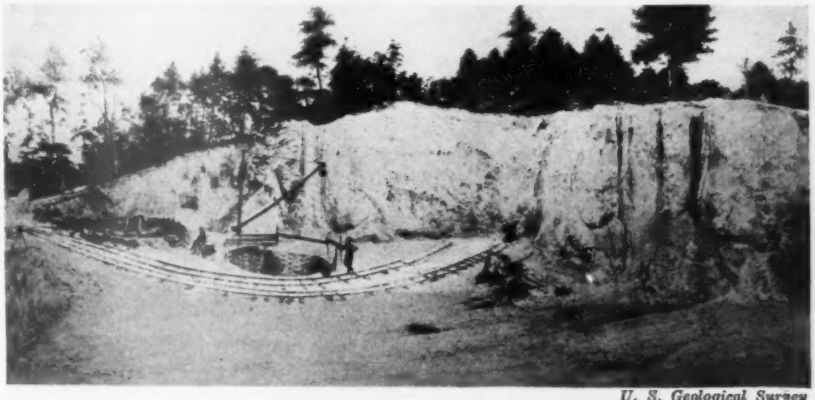
THE development of the kaolin and white clay industry of the southern states is usually considered as comparatively recent and this is true of its present rather extensive operations. However, according to Stull[1] high grade clay was produced and exported to England from Georgia, the Carolinas and Florida as early as 1766. Stull further states that kaolin was discovered in the United States in 1745 which was 10 years before its discovery in England. The development of the English deposits and the Revolutionary War stopped the exportation of kaolin and the industry was dormant for over 100 years. In 1882 the Geological Survey reported production of high grade clays in the Carolinas and Georgia but the amounts were insignificant. In 1910 the total production of high grade clays, kaolin, paper clay, slip and ball clay, from the southern states, Virginia, North and South Carolina, Georgia, Florida, Alabama, Mississippi and Tennessee, was about 140,000 tons, valued at $650,000.00. In 1924 the southern states mentioned produced 291,000 tons valued at $2,785,000.00. Georgia was the largest producer with 135,504 tons. These figures briefly illustrate the growth of the industry in the past 14 years, both with respect to tonnage and value.

The total production of high grade clays in the United States for 1924 was 409,645 short tons, valued at $3,505,931.00,[2] of which the southern states produced 71 percent. This shows the importance of the high grade clay industry in the south to the consumers of these clays and the ceramic industry and consumers of clay fillers throughout the country.

There are at present about 42 active producers in the territory considered. The number of mines operated is in excess of this as some companies operate more than one mine or pit. Georgia ranks first with 13 active producers, while the combined Tennessee-Kentucky ball clay district have an equal number. South Carolina comes next with six active mines. There are probably in the neighborhood of 250 promising prospects or known occurrences of high grade clays in the different districts in addition to the actively worked deposits.

CLASSIFICATION OF THE CLAYS

The clays considered may be classified according to use, but as some clays are used for more than one purpose a classification based on physical properties is more rational. They may be broadly classed according to origin into true kaolins or residual clays and sedimentary or secondary clays properly called "clays." The terms "china clay," "kaolin," "white clay," etc., are sometimes indiscriminately applied. North Carolina is the principal producer of true residual kaolin. The production from the other states is nearly all sedimentary or secondary clay. The true kaolins have generally a lower plasticity than the secondary clays and as they occur mixed with considerable amounts of quartz, mica and weathered feldspar, have to be washed before shipment.



U. S. Geological Survey

Fig. 1—Mining kaolin, hand mine Woodrow, N. C.

Fig. 2—Clay pit, Immaculate Kaolin Co., Langley, S. C., showing overburden removed by cableway

The high-grade sedimentary clays may be classified into white clays and ball clays. Some of the white clays may be ball clays but this is unusual. The white clays constitute by far the greater amount of the production. They may be subdivided into flint clays, hard clays, semi-hard clays, soft clays and bauxitic clays. The flint clays here considered are scarce and have been but little developed. They are hard, do not slake in water and have little or no plasticity. They could be used in the manufacture of refractories. They are rarely a good white.

---

* Published by permission of the Director, U. S. Bureau of Mines, Department of Commerce.

† Mineral Technologist, U. S. Bureau of Mines.

[1] Stull, R. T. Vast Wealth Stored up in Georgia Clay. The Clay Worker, Sept., 1925, p. 201.

[2] Middleton, Jefferson. Clay in 1924, Min. Res. of U. S. 1924. Part 2, p. 117.

Fig. 3—Clay mine—Edgar Brothers Co.—McIntyre, Ga.

The hard clays are fine grained with white to cream color and are usually free from grit. They disintegrate to a granular form in water but do not slake to a slip. Mechanical working however develops plasticity. They are difficult to filter press as they settle slowly from suspension.

The semi-hard clays are of frequent occurrence and considerable commercial importance in Georgia. They are also found in northwestern Alabama but have not been developed there. They range from white to cream in color and can be slaked to a slip by long continued blunging. They can be filter pressed, but with some difficulty.

The soft clays constitute a large part of the present production and are largely used in the filler trade, especially for paper. They are cream to white in color, slake and filter readily, and are finding an increasing application in the ceramic industry when properly used.

The bauxitic clays are so far found only in Georgia in commercial quantities. They are probably mixtures of clay and bauxite and may range from a pure white to a buff in color and from soft to hard in texture. Their alumina content varies from 40 to 48 percent.

LOCATION AND DESCRIPTION OF DEPOSITS

The deposits of sedimentary clays with the exception of those in Florida all occur in a general line or rather long curve following approximately the inner edge of the coastal plain and embayment area or just outside of the Fall Line. It is sometimes called the Fall Line Hills. The clay bearing area begins in South Carolina and extends through Georgia and Alabama into northeastern Mississippi and western Tennessee. By no means is this whole area productive but the known economic deposits occur within it.

Virginia is a comparatively small producer. The present production comes from near Cold Spring, Augusta County. This and other deposits in Augusta County which are not developed were derived from the weathering of Cambrian shales[3] and so are classed as primary or residual clays although they differ considerably from the residual kaolin resulting from the weathering of pegmatites. Some of the deposits are 60 feet thick with from 10 to 25 feet of overburden. The clay is better suited for filler than for ceramic use. The deposits in this district and the properties of the clay are worthy of further investigation. Prospecting may reveal the existence of other areas.

North Carolina is the only southern state producing true primary kaolin. When properly washed this product is of superior quality. It is used principally in white ware, floor and wall tile, spark plugs, electrical porcelain and similar ceremic wares. While some has been used for filler this is not an important application. The principal deposits are in the western or mountainous part of the state in Macon, Jackson, Haywood, Mitchell, Yancey and Swain Counties. The origin of the deposits has been discussed by Bayley.[5]

As the deposits are the result of weathering of pegmatite dikes they do not have great lateral extent, except along the strike of the dike but may extend to considerable depth, in which they differ from the flat lying sedimentary clay deposits of the other states. As kaolinization has progressed downward from the surface the completeness of the weathering becomes less until finally at some distance below the natural water level unaltered feldspar and the other minerals making up the dike are encountered. For this reason the deposits high up on the slopes are minable to greater depths than those in the valleys. Some deposits have been worked to depths of 125 feet.

South Carolina production is largely used for filler purposes, mostly paper. Some residual kaolins are found in the Piedmont area of the western part of the state but they are undeveloped. The sedimentary clays occur in the Coastal Plain and are produced in the Aiken district north of Augusta, Georgia, the district near Rayflin, in the northern part of Aiken County, and the Howell district east of Columbia. The greatest development is near Langley and Bath in the southern part of Aiken County. In this district the beds average 8 to 15 feet thick, sometimes reaching a thickness of 20 feet. The overburden, consisting mostly of sand with some clay and a small amount of gravel, varies from nothing to 60 feet. It is not unusual to strip 30 to 40 feet of overburden (Fig. 2). While most of the clay is prepared for the filler trade some is used in white and sanitary ware and electrical porcelain. Most of the clays are a good white color, some of them burn white, and some of the beds are sufficiently free from grit to be marketed as paper clay without washing. The deposits occur entirely as lenses or restricted areas; they are almost horizontal,[4] underlying from one to 10 or more acres. The lenses are often close together so that the pit or excavation from one is sometimes extended and carried into an adjacent bed of clay. These clays would be classed as soft to semi-hard.

Georgia ranks first in the production of high grade clays. They are all of the sedimentary or secondary type and vary in grade from flint clays to soft clays. The soft and semi-hard clays are, however, the principal source of production. The best known economic deposits occur in the northern part of the Coastal Plain in a broad band about 225 miles long by 40 to 50 miles wide extending from the Savannah River near Augusta in a southwesternly direction through Milledgeville and Macon to Columus on the west. The more important clays belong to the Upper Cretaceous formation.[6]

The deposits occur as lenses varying in extent from small areas a few inches thick to large areas of several hundred acres with a thickness of 40 to 50 feet. The amount of overburden, usually sandy clay, varies from nothing to thicknesses too great to allow profitable removal.

The principal producing localities are,

[3] Ries, H., Bayley, N. S., and others. "High Grade Clays of the Eastern United States," U. S. Geol. Sur. Bul. 708, p. 99.

[4] Weigel, W. M. The White Clay Industry in the vicinity of Langley, S. C. Bureau of Mines, Report of Investigations. No. 2382, 1922.

[5] Authority, C. Wythe Cooke, U. S. Geol. Survey, 1925.

Clay mine—Edgar Brothers Co.—McIntyre, Ga.

near Hephzibah in Richmond County, Gordon, McIntyre, and Claymont in Wilkinson County, Dry Branch in Bibb County, and Butler in Taylor County. Many other deposits in the clay belt have been examined and proved of economic value but are not yet developed.[6]

Florida clay is used to some extent as a filler, especially in rubber, but finds its greatest application in the ceramic industry as the clay is white burning and very plastic. It is sometimes erroneously called a ball clay but it is not a ball clay in the true sense of the word. It is used in porcelain body mixes to increase the plasticity of less plastic kaolin. It is found in the peninsula section and produced in Putnam and Lake Counties. According to the U. S. Geological Survey[7] the clay is probably coextensive with the "lake region" of Florida and the possible area extends from Clay County on the north to the middle of DeSoto County on the south, or about 150 miles north and south by 10 to 40 miles east and west. The clays as found consist of a mixture of clay, grains and pebbles of quartz, and mica. The overburden of sand is from 4 to 10 feet thick where it is worked. All the clay is washed before being marketed. According to Gunter[8] the clay beds are 6 to 30 feet thick with an overburden varying from 6 to 20 feet.

Alabama so for has produced very little high grade clay. This is due partly to the fact that most of the known deposits are too far from transportation or have too heavy an overburden. Also the properties of the clays are not as well known. Deposits of white sedimentary clays are known to occur along the line of a curve beginning in Barbour County in the southeastern part, across the state line from the Georgia belt, and extending through Sumter and Marion Counties on the west to Colbert County in the northwest corner of the state. In Barbour County a deposit near Baker Hill has been worked by a small local pottery. The clays near Hackleburg, Marion County, were at one time a source of small production, but have not been active in recent years. Also a small amount of clay has been produced near Allsboro in Colbert County. With the exception of some of the deposits in Colbert County the clays are covered by a heavy overburden, sometimes over 100 feet, except where they outcrop on the sides of narrow valleys. This means that in most cases underground mining will have to be resorted to for extensive development. The thickness of the beds varies from a few inches to 20 feet or more. Not enough prospecting has been done to form any idea of their horizontal extent.

The clays are soft to semi-hard and those in the northwestern part of the state carry considerable amounts of very finely divided silica. With a few exceptions the color of the raw clay is inferior to the best from Georgia and South Carolina, although some of them burn white.

There are some deposits of residual kaolin in Alabama. Those near Dadeville, Tallapoosa County, occur in a weathered pegmatite dike which has been worked to some extent for mica. Deposits of residual kaolins are also reported near Milner, Pinetucky and Micaville, Randolph County and Stone Hill, Cleburne County.[9] Near Fort Payne, DeKalb County are some deposits of residual clay derived from Cambrian rocks. Some of them are a good white and have promise for filler and white ware use. One deposit has produced a small amount used as a ball clay. At one time a small amount of ball clay was produced near Bynum, Calhoun County. This deposit is apparently residual, derived apparently from schistose rock.[10]

Mississippi so far has had no production of importance. Promising deposits, however, occur in the northeastern part of the state near Iuka in Tishmingo County. Some of these have been partly developed and small shipments made. Thicknesses of 20 to 30 feet have been noted. Overburden consisting of laminated sandy clays, in some cases quite indurated, varies from 4 to 5 feet up to 40 to 50 feet when the clay underlies some of the higher hills. The clay is rather low in plasticity but the color is fair and offers some promise for ceramic use although it is rather high in silica, which occurs in very fine grains resembling tripoli.[11] Farther south in Tishomingo County the clay is more plastic.

Near Enid a highly plastic clay has been developed and worked for some time. It is too dark burning for white ware, or use as a ball clay in white bodies, but has considerable value as a plastic clay in refractories. Some of the deposits are as much as 40 feet thick. The overburden of gravelly loam varies from 4 to 30 feet.

Tennessee and southwestern *Kentucky* are noted for their deposits of ball clays, which occur mostly in Henry and Carroll Counties in Tennessee and across the line in Calloway, Ballard and Hickman Counties, Kentucky. The clays lie in nearly horizontal beds or lenses. The workable portions are from 6 to 16 feet thick with overburden of sand and clay varying from 4 to 20 feet. Various grades of clay are produced classed as ball, sagger and wad. The white burning clays can be used in white ware and the others in various other ceramic products. Some are particularly suited for bond clays in the manufacture of graphite crucibles. The occurrence of the Tennessee ball clays has been covered by numerous reports.[12]

Undeveloped Resources Or Reserves

No estimate claiming any degree of accuracy have ever been made or are possible showing the tonnage of the different clays that may be available.

---

[6] Stull, R. T. and Bole, G. A. Beneficiation and Utilization of Georgia Clays. U. S. Bureau of Mines, Bul. No. 252, in press. Weigel, W. M. Georgia and Alabama Clays for Filler Use. U. S. Bureau of Mines, Technical Paper No. 343, 1925.

[7] Ries, Bayley and Others. High Grade Clays of the Eastern U. S. U. S. Geological Survey Bul. 708, p. 289, 1922.

[8] Gunter, Herman, State Geol. The Clays of Florida and their Possibilities. Manufacturer's Record, Jan. 28, 1926, p. 60.

[9] U. S. Geol. Survey Bulletin 708, p. 82.

[10] U. S. Geol. Sur. Bul. 708, p. 130.

[11] Lowe, E. N., U. S. Geol. Survey Bul., 708, p. 207.

[12] Nelson, W. A., "Clay Deposits of West Tennessee, Tenn. Geol. Sur. Bul. 5, 1911. Schroeder, R. A., "Ball Clays of West Tennessee," Min. Res. of Tenn., vol. 9, No. 2, April, 1919. Ries, H. & Bayley, W. S., "High Grade Clays of Eastern U. S.," U. S. Geol. Sur. Bul. 708.

There is no doubt that the reserves of the sedimentary clays are enormous, especially in Georgia and South Carolina, and will last for many generations at the present rate of production. The extent of the Florida deposits is uncertain but they are undoubtedly extensive. Alabama has extensive beds but development will be delayed largely on account of the depth of the clays below the surface and to the fact that they differ considerably in quality from those now used and more knowledge as to their properties and proper use must be acquired before their value can be capitalized.

The known reserves of the residual kaolins represented by the North Carolina deposits is undoubtedly limited but it would not be safe to make any estimate as new deposits may be discovered as the present supplies become depleted.

Mining and Preparation

Residual Kaolin. In North Carolina a method of mining has been developed to suit the local conditions and character of deposit. Mining by open cuts is practiced where feasible. The discolored overburden of the dike is first carefully removed and if the outcrop is on a hillside provision made to keep out any surface water. The material is then removed in benches either proceeding along the strike if it parallels the hillside or against the strike if the dike runs into the hill. The good kaolin on each bench is first carefully removed before disturbing any waste which is taken out last. Either wheelbarrows or cars are used to transport the kaolin to the edge of the cut.

In many cases shaft mining is employed especially where the kaolin extends to a considerable depth. Shafts may be started at the surface but quite often the upper part of the dike is first removed by open cut and the shafts then sunk from the floor of this as shown in Fig. 1. These shafts are circular, 14 to 20 feet in diameter and sometimes extend to a depth of 120 feet. If the dike is not vertical they are started in the hanging wall but often the entire shaft is within the walls of the dike. In sinking, about 4 feet is first excavated and trimmed to a circle of the desired diameter. This is then timbered with blocks of wood 4 by 6 inches by about 30 inches long, the ends being cut on a bevel so as to key into the circumference. The blocks are placed to break joints as in brick work. Another 4-foot cut is removed and another ring of blocks placed. This procedure is followed to the bottom of the kaolin deposit. At the bottom short tunnels are run from the shaft in any direction in which kaolin is found, and carried as far as possible without timbering. The areas between the tunnels are then robbed and the tunnels and the corresponding depth of shaft are then filled with waste and another level of tunnels driven directly over them. In this way the entire volume is removed to the surface. The shaft cribbing is removed as robbing proceeds upward and can be used again in another shaft. Hoisting is done in buckets by a swing boom derrick as shown in the figure. Another shaft is then started nearby or sometimes more than one is sunk at the same time.

Very little change in methods of preparation or washing has been made in recent years. The mixed kaolin, quartz, mica and feldspar from the mine with the necessary water goes first to a blunger or disintegrator to break up the lumps and get the kaolin in suspension. Often two blungers are operated in series. These discharge to the sand wheel by which the coarser grains are removed and from this the "slip" goes to a series of long troughs in which the finer sand and mica are settled out. These troughs discharge onto fine screens, either stationary sloping, or revolving which removes most of the fine mica that may not have settled out in the troughs. From the screens the clay and water goes to settling tanks or "concentrators." After standing a sufficient time the excess water is drawn off and the thickened "slip" pumped through filter presses. Alum is sometimes used to hasten the settlement of the clay. An agitator is sometimes introduced between the settling tanks and filters. The ordinary leaf type filter press is generally used, but some progress is being made in the use of the continuous vacuum type of filter.

Drying of the filter cakes is done by air or steam pipe heated floors or tunnel driers. The tunnel driers are usually steam heated.

Sedimentary Clays. Mining methods in South Carolina and Georgia are somewhat similar as the type of the deposits is essentially the same. Stripping of the overburden is done by steam shovel or slack line cable ways. The former is more in favor in the Georgia district and the latter in South Carolina. Typical cases are shown in Figs. 2 and 3. The last few inches of overburden and sometimes the top layer of clay is carefully removed by hand so as not to contaminate the clay with off color material. Excavation of the clay may be by hand with pick and shovel at small operations or by steam shovel at the larger mines as shown in Figs. 3 and 6. In some places light charges of blasting powder are necessary to loosen the clay. The clay is loaded into cars and hauled by cable or dinkey locomotive to the preparation plant. The treatment or preparation given depends upon character of crude clay and its ultimate use. Most of the South Carolina clay is not washed as the grit content is quite low in well selected material. Some small quantities are shipped in lump form after air drying on racks. Most of it is pulverized in Raymond Roller mills or high speed impact pulverizers and shipped in paper or burlap bags. Pulverizing is preceded by drying either by air on racks or in mechanical dryers. The tendency is toward mechanical dryers of the rotary type as then the operation of the plant does not depend on atmospheric conditions and such large stocks of crude clay do not have to be carried.

Most of the producers in Georgia wash their clays. Some of the plants very closely resemble those described for washing North Carolina kaolins, consisting of a blunger followed by a sand wheel or coarse screen, the mica and sand troughs, other fine screens, settling tanks and filter presses.

Within the past few years more technical skill has been brought to bear on the problem with the result that the larger producers are studying and trying out improved methods of washing which are more efficient—give a better clay extraction, and make a more uniform product. The clay recovered or the yield at the different plant varies from 60 to over 90 percent. This is in comparison with an average clay recovery of about 15 percent from the Florida deposits.[13] No use is made of the waste or impurities washed out. Improvements in washing processes have followed two lines. In one it is toward improvements in operation and construction on old principles with some tendency toward the use of electrolytes to deffocculate the clay during washing and flocculate it before filtering. In the deflocculate it before filtering. In the other, radical departures from previous practice have been made. In one of the newer plants the essential features consist of passing the clay slip through a tube mill and using a Dorr thickener as shown in Fig. 5. From the thickener the thickened pulp is partly dried on rotary steam cylinders and finished in a rotary drier.

The filter cake is usually steam dried. For ceramic use it is shipped in lump form. Much of the filler trade demands a pulverized product and to meet this demand it is pulverized and bagged.

Tennessee and Kentucky ball clay is marketed without washing, but considerable care is required to properly select the different grades, as one pit may produce more than one quality of clay. The pits are usually excavated below

[13] Gunter, Herman, "Clays of Florida and Their Possibilities," Manufacturers Record, Jan. 28, 1926, p. 60.

(Weigel) *Fig. 5—Clay preparation plant of Akron Pigment Co., McIntyre, Ga.*

(Weigel) *Fig. 6—Mine of Gordon Kaolin Co., Gordon, Ga.*

the level of the surrounding country. Stripping is done by horse drawn scrapers or, if it is unusually heavy, by steam shovels. At one pit an overburden of 45 feet is removed by steam shovel and hauled away by locomotives. The clay is mined by hand as selection and sorting is usually required. Blasting is often necessary. Some pits are served by overhead cable ways for the removal of the cars from the pit, but the most common method is to haul the cars up an incline by cable haul. At small pits a swinging boom derrick is employed. When time permits the clay is dried before shipment.

Utilization

North Carolina residual kaolin and the small amounts from other states, is used in the ceramic industry for white ware, sanitary ware, electrical porcelain, wall and floor tile and similar products. It is more like English clay than the sedimentary clays of the Coastal Plain region. Analyses and results of numerous tests have been given by Watts, Ries and others.[14] These kaolins have not found much use as fillers. The fact is they are worth more for ceramic use.

The South Carolina clays while used to some extent in ceramics have found their greatest outlet as fillers mostly for paper as they have good color, and slake readily to a smooth slip.

The Georgia clays are more diversified in character than those of any other state. While their greatest use so far has been for fillers in paper, rubber, paints, oilcloth and similar products, their use in the ceramic industry is increasing as research and study have revealed proper methods of manipulation and use. I have shown[15] that many of the Georgia clays are fully equal to and in some cases superior to imported clays for paper filling. Shaw and Bicking[16] conclude that with some slight differences in color and grit content of small importance, American clays are as good for paper as foreign clays. The American clays they tested were from Virginia, South Carolina and Georgia, some of which were not washed.

Georgia so far has produced the most suitable clays for rubber and oilcloth. Some Mississippi clays show possibilities for use in rubber. In the main their color is inferior for paper, paint and other uses requiring a good white.

The flint and hard clays of Georgia will probably find their most extensive use in the manufacture of refractories and special building brick. A new and unique development is that recently initiated at Gordon, Ga., of making a white or light colored face brick from hard clay and aplite, a locally secured fluxing material. Bole and Stull[17] have shown that many of the Georgia clays may be used in varying proportions in whiteware, tile and other products and in refractories.

The use of Florida clays is limited to the ceramic industry as a plastic or semi-ball clay. The washed clay is a high grade product, white burning and refractory. It is used in practically all grades of products where a white burning plastic clay is required.

Tennessee and Kentucky white burning ball clay is used in all types of white ware. The darker burning bond clays find use in refractories, chemical stoneware, pottery and graphite crucibles. They have to a considerable extent replaced the ball and bond clays formerly imported from England and Germany.

The high grade clay industry of the South is com- (*Continued on page* 171)

[14] Watts, A. S., "Mining and Treatment of Feldspar and Kaolin," U. S. Bureau of Mines Bul. 53, 1913. Ries, H. and Bayley, W. S., U. S. Geol. Sur. Bul. 708, 1922.

[15] Weigel, W. M., "Georgia and Alabama Clays as Fillers," U. S. Bureau of Mines Tech. Paper 343, 1925.

[16] Shaw, M. B. and Bicking G. W., "Comparison of American and Foreign Clays as Paper Fillers," Bureau of Standards Tech. Paper 262.

[17] Stull, R. T. and Bole, G. A., "Refractory Possibilities of Some Georgia Clays." Jour. Amer. Cer. Soc., May, 1923. "Use of Sedimentary Kaolins of Georgia in Whitewares," Jour. Amer. Cer. Soc., July, 1923. "Utilization of Georgia Kaolins in Manufacture of Face Brick," Jour. Amer. Cer. Soc., May, 1924.

Fig. 4—Mining soft clay near McIntyre, Ga., showing method of stripping overburden and mining the clay

WHITE CLAYS AND KAOLIN IN 1925

The Clay Industry Has Been Struggling Against Highly Competitive Conditions—Protective Tariff Essential To Development Of American Operations, Which Are In Spite Of Handicaps Substantially Increasing Production—A Review Of Accomplishments And Possibilities Of Clay Industry

By R. T. VANDERBILT *

CLAY MINING is in tonnage one of the large mining industries of the United States, the total volume produced annually exceeding 10,000,000 tons. In this article, however, we refer only to the higher grades of Kaolin, China Clay, Ball Clay, etc., mined and sold, and imported, mostly white clays; and we have not attempted to cover the great tonnage of fire clays and other cheap grades.

Since 1920 there has been a considerable increase in the consumption of clay and kaolin in the United States and also in the development of the American mines. We estimate that the consumption in 1925 was over 900,000 tons. The imported grades have captured more than 50 percent of our market, due to unfortunate conditions we will refer to.

Comparative figures for six years are as follows:

	American Clay (Tons)	Imported Clay	Total Consumption
1920.....	337,680	396,052	733,732
1921.....	216,740	204,327	421,067
1922.....	352,467	350,760	703,227
1923.....	433,871	376,677	810,548
1924.....	409,645	435,686	845,331
1925 (Est.).	430,000	490,000	920,000

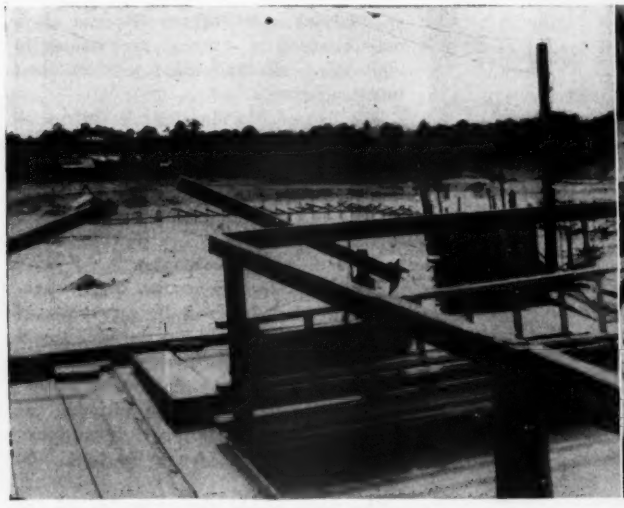
The American mines have had a hard pull of it to make both ends meet during the past few years, due both to sharp competition from abroad and the keen competition of the native mines among themselves. More than 95 percent of the imported clays come from England and about 75 percent of these importations are so-called low and medium grades, which are in competition with American clays. There is a surplus in England of the low grade mines. Also due to the formation of some of the deposits, high grades of clay are found in the same workings as lower grades, and to mine these high grades economically it is at the same time necessary to move the lower grades. It is the practice of the English producer to force this double supply of lower, actively competitive grades into the United States at whatever price will move them, exacting much higher prices for the smaller tonnage of the better grades, with which our domestic clays do not readily compete. These higher priced grades are going particularly to the pottery trade and to the paper coaters and cloth fillers.

The practice of sacrificing prices on the competitive grades to move them into this country has been greatly accentuated during the past eighteen months and the situation for domestic clays is probably worse in this respect than it has ever been heretofore. From published statements it is evident these competitive grades of English Clay are being sold at a loss with the primary object of capturing this market and discomfiting the domestic producer. Statements are made that some of the weaker English operations have been forced to suspend because of these ruinous prices but that the lower prices made have served to capture in part this market and to that extent the methods employed have been successful.

Such methods threaten the very existence of those grades of white domestic clays we refer to. In the past the English producers have maintained a price fixing association. Such an association in this country would have been illegal. By means of this they were able to artificially maintain prices. That association has been broken up but it is apparent that the producers of the high grade non-competitive clays have still agreed on certain price levels and because of the lack of domestic competition in those grades, are able to exact relatively high prices from the United States consumer. Various schemes have been suggested for reorganizing the association and it has been suggested that a new one be formed which through a centralized capitalization and control, can deal more efficiently with the competition of clays produced in this country.

The geology and character of the various American clay formations has been fully covered in many standard publications. The high grade clays or kaolin are found here in sedimentary deposits in the Southern coastal plain, the largest productions being in the states of Georgia, South Carolina and Florida, and smaller outputs in Pennsylvania, North Carolina, Alabama, Ten-

*R. T. Vanderbilt Co., Inc.



Dredging clay at a typical Florida mine

Clay from filter presses drying on steam racks

A clay preparation plant in Georgia

nessee and Virginia. The bulk of the production is in the far South and most of the consumption is in the East and Western parts of the country, necessitating high freight costs in reaching the markets. Imported clay comes in mostly at the following points: Portland, Me.; Boston, Mass.; New York City; Philadelphia, Pa.; Baltimore, Md. These foreign clays are carried at low ocean freight costs, at present some 12 to 13 shillings per ton of 2,240 lbs. or about $2.70 per short ton. The rate on clay from Georgia to Boston is $7.92 per ton.

As a general statement, clay can be shipped from a mine in Cornwall, England, to a mill in Maine or Massachusetts, at a lower cost, including the American import duty, than the freight from a Georgia mine to the same mill.

The American grades are able to compete in the Western markets where the imported clay has to pay comparable inland freight charges. The industry, however, is almost completely shut off from the markets in New England and New York. The present tariff is $2.50 per ton and it is obvious that a tariff which does not permit the industry to sell to more than half of the market, does not give adequate protection. An appeal was made a year ago to the Tariff Commission to increase the duty 50 percent and while this has been under investigation no action has yet been taken. Most of the producers feel that an import duty of $5.00 per ton is necessary to adequately protect the native industry and that it is warranted.

Due to the natural formations of the residual deposits it is much cheaper to produce clay in England than in American mines and the industry is essentially one which is dependent on tariff protection. Many of the English deposits are 300 feet in depth and are mined hydraulically while the native southern deposits average some 20 feet in depth, necessitating a continuous stripping expense in moving the earth from over the clay, and a higher mining cost per ton.

In addition to the freight advantages which the foreign clays have enjoyed in all markets but the West, the eastern railroads in an attempt to secure an increased freight haul of imported clay, have recently granted a considerable reduction in freight rates from seaboard points to the western consuming market, which have had the effect of partly nullifying the small tariff protection the industry has. It is questionable whether the Interstate Commerce Commission has the right to grant a reduction of this sort, having the effect of nullifying tariff protection, without granting comparative freight rate reductions to domestic producers. Due to these conditions the industry has not been able to operate on a profitable basis but the general feeling is that the situation is at its worst and any further change will be for the better.

Partly because of these highly competitive conditions various economies have been brought about in the production of clay and the industry has become comparatively hard-bitten and efficient. New capital has been invested to improve the existing plants. A number of the weaker mines have had to stop operating and many of the existing mines have gradually gone into stronger hands and have developed better management. Below is a table showing the production by states in 1923 and 1924, partly as given by the Bureau of Mines and partly estimated, with some minor productions omitted:

	1923 Tons	1924 Tons
California	4,000	6,000
Florida	55,000	55,000
Georgia	125,000	135,000
Illinois	4,000	4,000
Kentucky	30,000	28,000
New Jersey	11,000	6,000
North Carolina	23,000	17,000
Pennsylvania	60,000	62,000
South Carolina	55,000	40,000
Tennessee	50,000	40,000
Virginia	15,000	15,000
	432,000	408,000

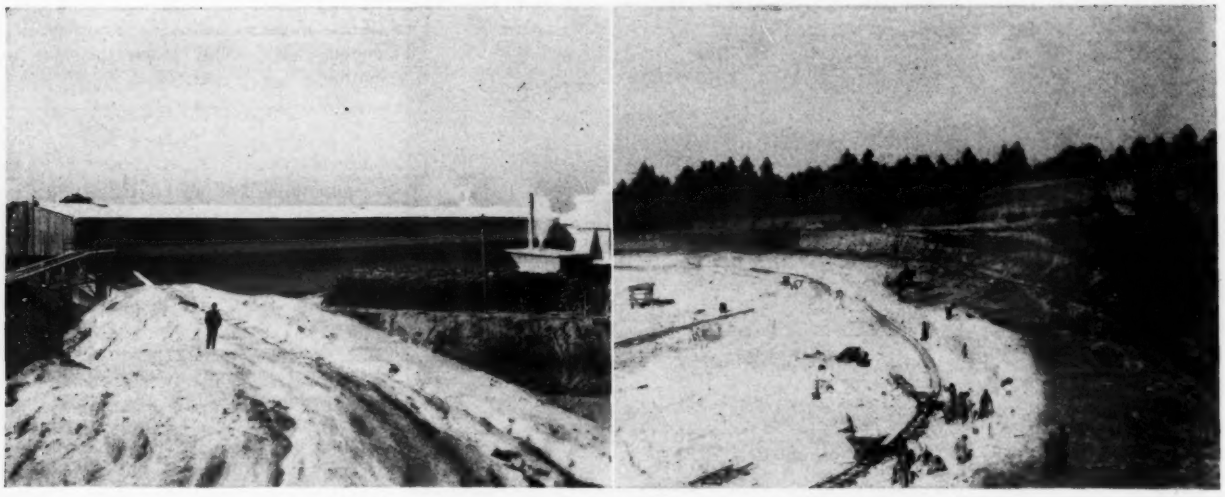
It is not generally recognized that the paper mills are by far the largest consumers of white clays. Book and magazine papers ordinarily contain 20 percent of clay, which improves the surface and printing qualities of the sheet. Other papers after being made are given an extra coated surface of clay. These are the shiny papers used for special printing, such as illustrations in books.

The largest production is in Georgia where most of the clay is produced in the region around Macon. Practically all of the clay is washed and about 80 percent is sold for filling in book and magazine papers. The balance goes for pottery, and for filling in paint, cotton goods, oilcloth, etc. The clay beds in this district range in depth from 10 feet to 30 feet and lie under an overburden or earth covering of from 10 feet to 60 feet. As will be noted from the photographs the overburden is stripped off by steam shovels. The clay is mined by hand and conveyed to the refining plants where it is washed and dried. From 10 percent to 15 percent of mica and silica is ordinarily extracted. The Georgia clays have the following average analysis:

	Pct.
Silica (SiO_2)	45.50
Aluminum Oxide (Al_2O_3)	39.00
Iron Oxide (Fe_2O_3)	.50
Titanium Oxide (TiO_2)	1.00
Calcium Oxide (CaO)	.05
Magnesium Oxide (MgO)	.10
Sodium Oxide (Na_2O)	.05
Potassium Oxide (K_2O)	.20
Ignition loss	13.60
	100.00

Residue on 200 mesh sieve 1/100 of 1 percent.

In South Carolina the production has been gradually dropping off until 1923, when two of the larger mines were consolidated into a new company and additional capital supplied to develop the mines and secure proper equipment to prepare the clay for diversified uses. All of the South Carolina clay being mined is found in sedimentary deposits free from grit, so that it is shipped out without washing. Some of it is so thoroughly washed by nature that it is useable for purposes for which the washed imported grades are not suitable, such as in flint



Mining and preparing kaolin in South Carolina

glazed papers. Some of these clays are the whitest of the American grades which have yet been located and are used for coating as well as for filling purposes. One quality has been developed into a grade for rubber filling which is recognized as the standard rubber clay, showing exceptional wearing qualities and tensile strength when added to rubber compounds. It is even shipped abroad, being the only American clay to be exported. This clay is carefully dried and pulverized to an extreme degree of fineness. Another grade has particularly good qualities for a filler in oil paints, and a considerable use has been developed for it. The balance of the clays are used for wall paper coating, paper filling, certain ceramic purposes, etc. A typical analysis is as follows:

	Pct.
Silica (SiO_2)	44.99
Aluminum Oxide (Al_2O_3)	39.90
Iron Oxide (Fe_2O_3)	.34
Titanium Oxide (TiO_2)	.73
Calcium Oxide (CaO)	Trace
Magnesium Oxide (MgO)	Trace
Sodium Oxide (Na_2O)	.12
Potassium Oxide (K_2O)	.10
Ignition loss	13.82
	100.00

Photographs show several of the mine operations with some of the larger grinding plants. In all the larger companies the development now includes the building of large storage warehouses in which considerable tonnages of clay are accumulated during the good weather season for shipping out in the bad weather of winter and the rainy season. In all the southern operations negro laborers are used, common labor getting about $2.50 per day. Also in the largest of the South Carolina operations workmen houses have been built in which negro workmen are housed, assuring a skilled and reliable labor supply.

The industry has progressed many years beyond the "clay farmer" stage where local miners with no capital dug out clay when they could and shipped it undependably to the consumers, who used it as a cheap supplement to their normal supply. Many millions of dollars are now invested and with proper protection, the industry is capable of growing rapidly and meeting all demands upon it.

The operations in Florida are rather unique in the clay business, all of the clay mined there being dredged from under-water deposits and washed and dried at the plants. The overburden varies from 8 feet to 15 feet and the clay from 30 to 40 feet in depth. With the exception of a small tonnage which is used for rubber filling, all of this clay goes into the pottery trade, where it is well established through many years of ceramic use. Practically every American potter uses in his mix a percentage of Florida clay varying from 5 percent to 30 percent and these clays are noted for their strength, uniformity and good color. It is particularly valued by the electrical porcelain and dinnerware manufacturers. There are at present four producing plants in operation and the tonnage in 1925 is estimated as 65,000 tons.

In North Carolina the production has been variable, due principally to the ununiformity of the deposits, all of which are pockets of varying sizes. The best of the North Carolina clays are of remarkably fine color and are used for this quality, in high grade chinaware and wall tiles. While the production is small, there is a steady, though limited demand for these grades at about the highest prices which are paid for any American qualities. There are at present only two or three producing companies.

An interesting development of the past few years has been the opening up of a sedimentary clay deposit in Virginia, where a large bed of clay showing unusual depth in places has been successfully manufactured for the market. This clay deposit is half way up a mountain, some three miles from the railroad. The clay is transported by an aerial tram and all of it is dried and pulverized before being shipped out. Practically all of the production goes to several of the large paper mills making high quality magazine paper. The photographs on the next page show the clay pit, and the plant at the railroad.

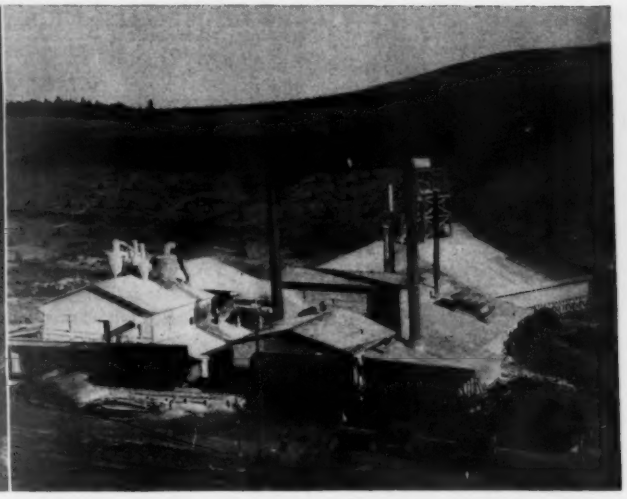
In New Jersey there has been no particular change in the situation for several years, the usual grades of ball and fire clays being produced. New Jersey clays are used principally in the manufacture of refractories, sanitary ware, terra cotta, saggers, plaster and refractory cements. These clays are sold mostly to the local factories at low delivered costs, and do not come in competition to any extent with imported clays.

In Kentucky and Tennessee there has been a gradually increasing production of ball clays used in all white wares, and sagger clays. There has been no sizeable new development during the past year.

In Missouri there has been a new grade of clay mined which has some particularly interesting properties for the ceramic trades. These clays are black lignitic grades which burn out white, show a particularly high tensile strength and do not craze. They are apparently a cross between a ball clay and a China clay and show promise of considerable development.

Pennsylvania produces a few grades of washed clay which are largely used for paint, wall paper and special filling purposes, and the production remains quite constant, there having been no new developments in this field. The balance of the Pennsylvania production is low-

One end of a Virginia clay mine showing clay banks after overburden has been removed



The plant at the railroad—storage buildings, dry pulverizers. Capacity—125 tons of pulverized clay per day

priced crude clay and a very large production of fire clays.

In South Dakota and Wyoming there has been produced for a number of years a rather remarkable grade of clay, commonly known as bentonite. It is probably a volcanic ash product, which has been wind-borne and settled in the drifts in which it is now found. The finest grades, due to the very small size of the particles and their colloidal nature, will absorb some 15 times their weight in water. This remarkable absorptive power is of course, valuable for many purposes, such as a carrier for other materials in a compound. The sale of the clay has been increasing gradually. It has been used to absorb the printing ink in a repulping process of old papers, in compounds, as a soap ingredient and for coating and surrounding asphalt particles in water emulsified asphalts. Some California qualities are being successfully used for oil filtration in place of fullers earth.

There is also a great tonnage of fire clays and coal measure clays produced at low costs. Some of these low priced clays are being used for rock dusting in coal mines in competition with other cheap ground minerals.

The Bureau of Mines reports the production of fire clay in 1924 in Pennsylvania at 554,000 tons, Missouri 454,000 tons, Ohio 249,000 tons, New Jersey 268,000 tons, and a total production of fire clay of 2,443,000 tons. The 1924 figures show a total of all grades of over 5,000,000 tons sold for consumption, and this does not include a much larger quantity mined and used by the producers themselves.

There is clay found in practically every state and scattering unimportant productions in a number of states other than those mentioned. The field has only begun to be developed and constant search is being made for new clays and many interesting grades are being unearthed, many of them too far from the railroads or too far from the markets to be commercially workable at the present time.

The clay industry has before it promise of greatly increased tonnage over a period of years, and there has been a steady increase in consumption. It is vitally important to all American users of clay that the industry be maintained and supported, as without its competition, there is little doubt that the prices of foreign grades would have a tendency to follow the course rubber prices have taken during the past few years. The industry needs protection to exist, due to natural causes which affect its costs. It would be a very short-sighted user of clay who would endeavor to bring about conditions which would result in crippling the industry with a temporary saving of a few cents a ton in his clay cost, or who would lend any American support to the present organized effort to curtail its development. It is not probable that the native industry will capture the whole of the American consumption for many years to come, but conditions should be arranged so that it can continue to grow, and at least take care of most of the increased American consumption with American clays. The larger the production it can secure, the lower the costs and prices.

POWER MAP OF VIRGINIA

THE Geological Survey, cooperating with the Virginia Geological Survey, has just published a new edition of the map showing electric power stations and transmission lines used in public service in Virginia and the river gaging stations maintained or proposed.

Virginia, with its large potential water power, of which only 11.2 percent has been developed, lies between the interconnected transmission systems of the South and the Northeast. These two systems will eventually be connected, and in bringing about this result the water powers of Virginia will be an important factor. The map may be obtained from the Director of the Geological Survey, Washington, at 50 cents a copy.

"The whole South is a fertile field for nonmetallics and the Bureau of Mines may recommend that more work be devoted to the production of clay in the South," declared D. A. Lyon, of the Bureau of Mines, in the course of hearings on the House bill making appropriations for the Bureau.

He said the Bureau had first contemplated establishing the nonmetallic station at Knoxville, but decided to place it at New Brunswick, N. J., on invitation of Rutgers College, because the territory between Washington, Columbus, and New York is a large consumer of these products.

Some early history of the Bureau in the location of its stations was given by O. P. Hood, of the Bureau. He said that Dr. Holmes, the first director, thought the Bureau, should be located in close touch with the industry to carry on mining investigations away from Washington. It developed that Western metal mining interests were not satisfied with a large laboratory at Pittsburgh in the coal mining region. Western mining interests believed the Bureau should do the same work for the mining industry as was done by the Agricultural Department through local experiment stations, which resulted in establishment of mining experiment stations in various parts of the country.

ECONOMIC POSSIBILITIES OF EASTERN OIL SHALES

A Discussion Of The Possibilities Of The Oil Shale Deposits Of Kentucky Which Possesses Vast Reserves Of High Quality Shale, That Are Fortunately Situated Both As To Markets And Transportation Facilities

By C. S. CROUSE *

IN considering the history of the development of the mineral resources of any new district, or indeed, of any country as a whole, three phases may generally be identified. The first of these is that following the discovery. It is the period of the rush when all is enthusiasm, fortunes are made over night and no thought is given to conservation or possible exhaustion of supply. This is the period in which it may be said that the cream is being skimmed from the milk.

The second follows the first, sometimes closely, sometimes after a long interval, but follow it must. This is the period in which thinking men, generally within the industry involved, sometimes without, begin to realize the ultimate depletion of the resource in question and to plan for the future. These plans may entail the conservation and utilization of waste products, the more economic handling, treatment and application of the resource concerned, or the development of substitutes. This period may last a longer or a shorter time, depending on the importance of the resource involved, the rate of its depletion, and other factors too numerous to mention but which a little thought will make apparent.

The third phase is one of gradually decreasing production and gradually increasing application of the methods and substitutes worked out during the second period.

Fortunately for this country, and largely due to its youth, we are scarcely out of the first period so far as most of our mineral resources are concerned. With a few, however, the situation is different, and this is the case with oil.

It is extremely fortunate for the future economic well-being of this country that the United States is bountifully supplied with almost unlimited deposits of oil shale from which untold millions of barrels of oil may be produced. Nor is this oil shale confined to any one section of the country. On the contrary, it is widely scattered from California on the west to Kentucky in the east and from Montana on the north to Texas in the south.

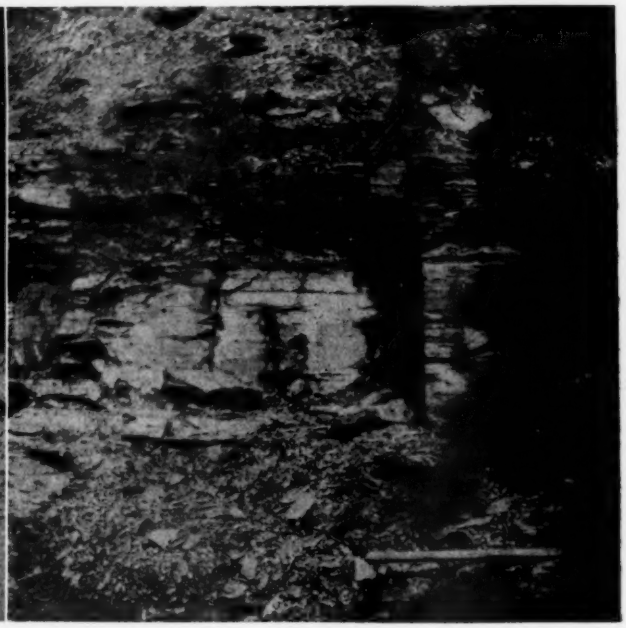
The shales of the western section of the country have become pretty well known both because of their spectacular occurrence and because of the efforts of an interested group of men. Of the shales in the eastern United States, however, comparatively little is generally known. Nevertheless this is not because of their lesser economic importance, as they have many points of advantage over the shales of the west, but rather through lack of publicity. This article deals principally with the Kentucky shales.

The principal oil shale deposits in the east and south are comprised in the Black Devonian Shales of Ohio, Kentucky, Indiana and Tennessee. Of these states Kentucky, probably, contains the greatest and most easily developed deposits.

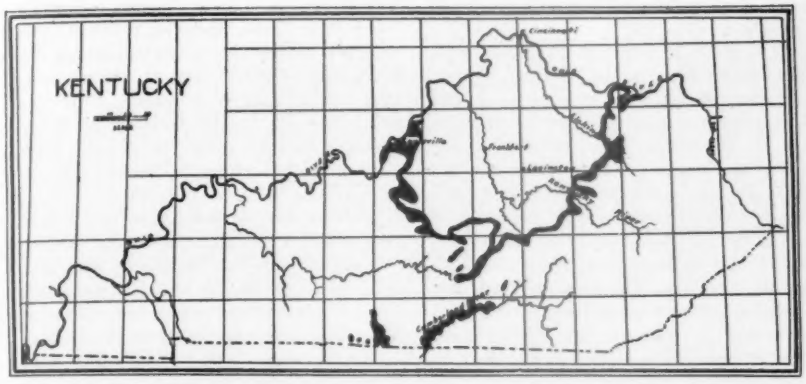
The shale in this section occurs in hills and knobs from 50 to 150 feet in height often joined by ridges and with their tops forming small, flat plateaus. The overburden, in most cases, is negligible being composed of disintegrated shale and decomposed vegetable matter and capable of supporting only sparse vegetation. In fact, this section of the state, with the exception of some of the valleys and creek bottoms, is practically worthless from an agricultural standpoint. These hills and ridges are cut by numerous valleys and dells which generally contain streams and rills, some seasonable to be sure, but practically all capable of furnishing enough water for plant

* Professor of Metallurgy, University of Kentucky, Lexington, Ky.

No. 2—This close up of a portion of a Kentucky shale hill shows the usual lack of overburden and rather sparse vegetation



An opening in a shale hill that gives an idea of the massive character of the unearthed shale which, at this point is 150 feet thick



Map of Kentucky showing oil shale outcrop in black

operation if dammed and the seasonal water thus impounded.

A conservative estimate of the oil shale outcropping in Kentucky, practically all of which may be mined by open pit or quarry methods, is one hundred billion tons. Further, the results of a large number of tests on shale from different localities in the state show that an average figure of one-half a barrel of oil to the ton of shale, is conservative. Much of it will run much higher. In fact a series of tests made within the past few weeks has shown certain shales to contain in excess of 30 gallons of crude oil of excellent quality to the ton. Taking, however, the figures of half a barrel to the ton, the conclusion is that the outcrop of shale in Kentucky alone is nothing more nor less than a huge oil reservoir holding, locked within itself, the stupendous total of 50 billion barrels of crude oil. No need to worry about the future oil supply of the nation with this vast store untouched.

However, the mere fact that such an amount of oil is present in the shale is not sufficient. Quality must also be considered. The mere statement that the quality is good is not enough. This must be proven. The writer has made many laboratory tests on oil derived from this shale and has found the gasoline and naphtha content to run between 30 percent and 40 percent and the kerosene fraction around 20 percent. Also, in his judgment, the crude should be capable of producing light and medium lubricants.

The factors governing the economic development of any oil shale may be summed up under the following heads: (1) Amount of shale available; (2) oil content of shale, both quantity and quality; (3) economic by-products; (4) methods and cost of mining; (5) crushing and retorting; (6) refining; (7) availability of water; (8) transportation; (9) closeness and availability of supplies and market; (10) labor and climate; (11) prospecting and sampling; (12) first cost of land, selection of plant site and validity of title. Manifestly some of these points are of more importance than others but all should receive consideration. In the following paragraphs will be found a brief discussion of the factors noted as applied to Kentucky shales.

Concerning the first two points sufficient has been said. Certainly there is enough shale yielding excellent quality crude oil to make its economic development desirable.

Economic By-Products

Two of these have been proven, i. e., fuel gas and ammonium sulphate. As has been mentioned, sufficient fuel gas should be made in the distillation of the average Kentucky shale to supply all the fuel needed in that distillation. In considering the amounts of ammonium sulphate obtainable the estimate has been based on the fact that an average analysis of 18 samples of shale from as many different counties shows the nitrogen content to be 0.4 percent which, figuring 60 percent of the total nitrogen as available for forming ammonium sulphate, which amount should be commercially recoverable, would give 37.7 pounds of this valuable by-product per ton of shale.

Although the above mentioned by-products are the only ones that have been proven, nevertheless there can be no question but that others will be developed and it should be of interest to indicate from what source these by-products are apt to come.

One of the problems of the shale industry will be the disposal of the vast amounts of spent material which, having passed through the retort, have been lessened in weight but not in volume. As this spent material averages around 57 percent silica and as considerable deposits of clay which might be used as a binder are found in the state, might not a brick, vitrified or otherwise, be made from this waste product? Again, with limestone so prevalent in the shale district might not cement be made from spent shale of the proper composition? Furthermore, the possibilities of using spent shale mixed with refining tars and residues is well worthy of investigation, especially in view of the fact that good roads in the shale country are largely conspicuous by their absence.

These few suggestions do not, by any manner of means, exhaust the potentialities of the spent shale, but merely serve to indicate the lines of investigation which seem to show the greatest present economic possibilities.

Methods of Mining

It is when considering this subject that the most marked advantage of Kentucky shales is found. The Kentucky shale formation lies in a nearly horizontal position with, generally speaking, practically no overburden on it, what there is being largely composed of a few feet of weathered and decomposed shale. This overburden will practically never have to be removed separately, but can be mined with the shale itself and fed direct into the retorts. For this type of deposit quarrying or open-cut methods of mining will prove to be by far the most economical and practical, especially when the fact that most of the shale lies above the level of the surrounding country is taken into consideration.

Whether quarrying in a strict sense of the word will be used or an open-cut method will depend on the topographical condition of the individual shale tract. If the shale occurs in hills, as is usually the case, quarrying, with or without steam shovels, may be employed, but if the tract is level an open-cut system, with the use of steam shovels, is indicated.

The advantages inherent in either one of the above methods are many, including as they do, low cost of mining with large percentage of recovery, large production with ease of supervision and few skilled laborers, convenient and efficient use of explosives and, the operations being conducted in daylight and the open air, there is no need for ventilation to rid the mine of poisonous or explosive gases, which fact makes for the health of the workers and a high degree of safety. In addition to these general advantages, which apply equally well to quarrying and open cuts, the hillside type of quarry has the further advantages that it is largely self-draining, the shale can be handled by gravity, and less drilling and explosives will be needed to break an equal amount of shale.

Crushing, Retorting and Refining

From the quarry the shale will go direct to the storage bins, and from these to the crushing plant. The size to which the shale will have to be crushed will depend largely on the type of retort used, some requiring very fine material and some coarse. However, in all cases, the crushing of the shale must be done in

such a way as to produce a minimum of fines, as the presence of excessive dust will cause retorting trouble in practically any form of apparatus that may be used. Fortunately the Kentucky shale crushed rather easily without gumming and with the production of less fine material than soft limestone or sandstone.

The next step in the process of producing shale oil is the eduction of the oil from the shale, or retorting. The method used is that of destructive distillation and has been previously referred to. No attempt will be made to discuss the relative values of the different types of retorts that have been devised, this having been done by the writer, so far as Kentucky shales are concerned, in a previous paper. However, it may be said that any retort to be commercially successful should be mechanically simple, be continuous, have a good throughput per day, have a low upkeep, a moderate operating cost, and be able to do the work that it is expected to do. This latter point means that the crushed shale should be subjected to a temperature gradually rising to a maximum of about 900 degrees F., for at least 45 minutes, without access of air, and that the gases should be withdrawn through the cooler portions of the retort so as to avoid, as much as possible, the cracking of the oil gas into fuel gas.

The Kentucky shales offer no particularly difficult retorting problems, there being several machines on the market that could probably be used satisfactorily on these shales at the present time. However, there are a host of others being presented to the prospective oil shale operator which have no value whatever, and a most careful examination and testing, together with consultation with the best authority should be taken before adopting any retort for a commercial plant. It is impossible to lay too much emphasis on this point.

Manifestly it would be folly to attempt to give any retorting costs without a knowledge of the form of retort to be used. Nevertheless, the fact remains that, considering that the retort selected is properly designed, the cost should be low, as the fuel, the chief item of expense, will be furnished by the fuel gas produced in the retorting operation itself. However, waste-heat boilers should be placed in the flues in order to utilize the excess heat in the waste gases in raising steam. Especially is this true when superheated steam is to be used in the retorting operation itself, and this will pretty generally be done as its use increases both the quantity of oil and of ammonium sulphate as well. Probably a large proportion of the steam used around a plant, both for retorting and power purposes can be supplied through waste-heat boilers, if properly designed and operated.

In connection with the retorts proper there will have to be condensing apparatus, scrubbers to remove the light oil carried mechanically in the fuel gas stream, scrubbers to remove the ammonia gas and a sulphate plant for the production of ammonium sulphate, considering that the amount of nitrogen in the shale in question warrants its recovery. In addition gasometers for storing the fuel gas and a tank farm for crude oil storage, along with conveying apparatus to remove the spent shale after it leaves the retort and take it to the dump, are indicated.

In considering commercial shale operation one of the first and most important factors to be determined is what is to be done with the main product of the retort, the crude oil, after it is obtained. Three general possibilities present themselves: (1) It may be sold direct to refineries. Due to the fact that the methods used in refining crude shale oil will be somewhat different from those used in refining crude well oil, as good a price could probably not be obtained from refineries, at the present time, for crude shale oil as for crude well oil. In the future, when refinery men have been educated up to shale oil, as good or even a better price may be obtained, but this would probably not be the case now. (2) A topping plant might be erected which would make motor fuel and fuel oil. This would probably be the best practice under existing circumstances, as such a plant could be erected at comparatively small cost and a barrel of crude split into motor fuel and fuel oil would bring a much better price than though sold as crude. Especially is this the case in view of the high percentage of motor fuel in the Kentucky crude shale oil. (3) A complete refinery might be erected and all the usual refinery products made. This last method would probably give the highest monetary returns in the long run, but presupposes a large operation and plenty of capital at the start. This latter stage should develop naturally from a plant that has started operations with only a topping plant, and it would probably be best to work toward this end rather than to try to start operations so equipped.

Availability of Water

This point has been touched on. It is enough to say that water in sufficient amounts is available, or can be made available, at practically all points in the shale district.

Transportation

The shale section of Kentucky is rather plentifully supplied with railroad transportation. In the extreme northeast the Chesapeake and Ohio main line from Cincinnati to the Atlantic coast taps it at Vanceburg in Lewis County. Coming south from there, however, there is quite an area untouched by railroads till the main line of the C. and O. from Louisville to the east is reached. This line runs through Mount Sterling in Montgomery County, Salt Lick in Bath County, and Farmers in Rowan County, all towns in or near the shale. Coming further south the Louisville and Nashville reaches the shale with one branch at Clay City in Powell County and with another at Irvine in Estill County, the former joining the main line between Cincinnati and the south at Winchester in Clark County and the latter at both Winchester and Richmond. At the same time this main line penetrates the shale at Berea in Madison County.

Further west the main line of the Southern passes through the shale country at Junction City in Boyle County, where it crosses a branch line of the L. and N., which parallels the shale hills through Boyle County, passing through Lebanon in Marion County to meet the main line of the L. and N. from Louisville to the south at Lebanon Junction. This main line cuts through the shale just north and south of Shepperdsville in Bullitt County.

Thus it may be seen that the shale section of Kentucky is very well situated from the standpoint of railroad transportation, there being many commercial deposits directly on a railroad and many more within easy building distance. Another important point to be borne in mind is that access to any of these railroads is tantamount to direct connection with unlimited markets within comparatively short distances north, south, east, and west.

There is also one other form of transportation which, while not generally important in the district, may be a very potent factor in some portions of it, and that is water transportation. The Ohio River cuts the shale at Vanceburg in Lewis County and at Louisville in Jefferson County, while the Kentucky River is navigable up to and considerably beyond Irvine in Estill County.

Thus, taking all things into consideration, it is safe to say that no other shale deposit of comparable size in the United States is as well situated from a transportation standpoint as is the shale district of Kentucky.

Closeness and Availability of Supplies and Market

The oil shale district of Kentucky is extremely favorably located geographically for obtaining its supplies and marketing its products. The eastern half of the United States contains 90 percent of the population, 80 percent of the railroad mileage, 87 percent of the automobiles, and has 93 percent of the capital invested in manufacturing industries, and

These Kentucky hills, of solid shale, are from 50 to 150 feet in height and are often joined by ridges. Level land, suitable for plant sites, usually adjoins the hills

A shale exposure in a good quarry. Attention is called to the almost horizontal stratification and to the scant vegetation and overburden

the Kentucky oil shales are in direct, close railroad communication with all this area as well as with the Atlantic seaboard for export. In addition, there is, through St. Louis, direct railroad communication with the West. These facts of unlimited market and good transportation with short hauls and consequent low freight rates on supplies and products give the shales of Kentucky a very marked advantage over those of the West.

Labor and Climate

The majority of the population of the shale counties is rural, and especially is this true of the shale district proper. In most cases the labor demand could be satisfied from native sources. Where this is not the case, the labor fields of Ohio and of the entire industrial East are close by.

The climate of the entire shale area is about the same and comparatively dependable. The winters are rather short and of moderate severity with long summers, which at times become rather hot, but with, as a usual thing, the heat frequently broken by rains and cool spells. The climate as a whole is delightful, with no long-continued periods of either extreme heat or cold and with long, pleasant springs and falls. From the standpoint of continuous plant operation a more desirable climate could scarcely be hoped for.

Prospecting, Sampling, First Cost of Land, and Selection of Plant Site

In examining the shale district for a plant location the first things to be considered are proximity of transportation and water. Practically any location chosen would be close to water, but not all have means of transportation available. After having found a site near water and transportation the topography of the ground should be considered. If possible, the shale should average 50 feet thick, or more, lie in hills and ridges without any capping, and there should be enough valley space for a plant site with the floor of the valley below the bottom level of the shale, if possible, so that the material may be handled as much as may be by gravity from the quarry and through the retort. Fortunately these conditions are found to be pretty general throughout the shale district. In addition, plenty of space to care for the spent shale must be provided.

After the property has been carefully selected it should be optioned, if possible, and then prospected and sampled before a plant is built. The best and practically the only feasible way of getting absolutely reliable data on the oil content of a deposit is to do systematic diamond drilling, and any preliminary money spent in this way would be well spent. Moreover, the cost of this drilling should not be excessive, as the holes drilled would be shallow, seldom more than 100 feet deep, and the shale itself is not hard to drill. Then, given the information obtained from this drilling, the layout of the quarry, trackage, plant, etc., could be decided on intelligently and the operation carried on systematically.

The value of farm lands in the shale country is misleading, as the shale hills are worth much less agriculturally than the surrounding bottom lands on which this value is based. The shale land that has been already bought in the state for the purpose of exploiting the shale has been purchased at from $30 to $50 an acre, and all purchases have been made outright, and not on a royalty basis, a procedure that should be generally followed in Kentucky.

There is yet another point that should be mentioned in connection with the acquisition of shale land in Kentucky, and that is the question of titles. None of the land in Kentucky is divided into sections as in the newer states, neither is there any Government-owned land remaining, but rather was the land parceled out in the earlier days in the form of large land grants. Then these land grants were broken up and sold piecemeal and resold again and again, in some cases, and often with no official record of the sale. Especially is this true in the mountain country and the shale district, where the land was thought to be of very little value at the best. Consequently a very careful examination should be made of all titles before purchasing shale lands, and this examination should be made preferably by some one familiar with the Kentucky mountaineer and the status of titles in the district.

Conclusion

An analysis of the data given in the preceding pages shows that in every respect save possibly one, oil content, and this includes water, transportation, climate, labor supply, closeness to market and supply, cost of mining (ratio of one to three), method of mining, etc., the oil shales of Kentucky show a marked superiority from the standpoint of commercial operation. Such being the case, Kentucky is the logical place for the genesis of the oil shale industry in the United States, an industry which, in its potentialities, fairly staggers the imagination and one which the next few years should see obtaining a firm foothold in the industrial life of the East and South.

The writer wishes to acknowledge a rather free use and quotation from the following references:

Kentucky Geological Survey, Series VI, 1921, The Sixth Geological Survey, "Retorting Methods as Applied to Kentucky Oil Shales," C. S. Crouse.

Kentucky Geological Survey, Series VI, 1925, Oil Shales of Kentucky, "An Economic Study of the Black Devonian Shales of Kentucky," C. S. Crouse.

THE MICA INDUSTRY IN THE UNITED STATES

Demand For Mica Is Increasing, Particularly In Electrical And Radio Industries, But American Producers Are Unable To Compete With The Mica Produced In India By Cheap Foreign Labor—Adequate Protective Tariff Essential To Development Of This Industry

By S. HERBERT BROWN*

ALTHOUGH mica is a very common mineral and found in many parts of the world, its origin, use, and composition are little understood by the public. It is often spoken of as "isinglass," and understood to be used in old-fashioned stoves.

The word "mica" is from the Latin word "micare," meaning "to glisten." It was known to the ancient Greeks and Romans and used by them for window panes in houses and lanterns. They also considered powdered mica mixed with wine to have certain medicinal properties. Mica was also known to the North American Indians and employed by them for decorative purposes and mirrors.

The first large demand for mica came with the introduction of the continuously burning stove in America and afterwards in Germany. This demand was augmented by the use of mica cylinders for gas burners. The electrical industry, however, created a demand theretofore unknown, which warranted the opening up of mines in many parts of the world.

The different characteristics of mica are its great cleavage, dielectric strength, and resistance to heat. A mica crystal can be split to a thickness of less than one-half of one thousandth of an inch, and the flexibility and transparency of the sheets increase with the thinness.

Its principal uses are: In the electrical industry as an insulator, in the wall paper industry to impart a glitter to wall paper, in the rubber tire and paint industry as a paint and filler, in roofing material as an outside cover and protection from fire, and for window panes in stoves.

In speaking of the mica industry the subject must be divided into, first, production or mining; and, second, manufacturing.

In 1868 mica was discovered in North Carolina and for a decade there was a regular mining fever. The brilliancy and glitter of North Carolina mica was greatly desired by the stove manufacturers and warranted the mining of this material, but the largest part of the output was left on the miners' hands for the lack of demand. Wall paper manufacturers took part of the refuse, but not until the electrical trade called for cut mica and mica washers was the domestic miner assured of a market for his mine output. Later on the roofing, rubber, and paint manufacturers' demand for ground mica insured a still larger market for refuse mica.

The mica mining industry in the United States has had a checkered career. There have been instances where rich mines have paid handsomely for a few months or even a year, but covering a long period it could not be said that these mines paid the usual overhead expenses of an ordinarily incorporated company. It is to the small miners who follow farming as a profession and mine mica during the slack season, and who have persisted in their attempts to extract mica from hundreds of mines in the mountain regions, that the United States has produced so much mica. A great percentage of these small miners have scarcely made living wages.

However, at times of extreme high prices, such as during the World War, the mining industry was greatly stimulated. The United States Government sent their authorized agents to various mica fields, and, in conference with mica dealers and miners, stressed the importance of this country producing more mica for purposes of war material. The British Government had complete control of the large Indian fields, and were not in a position to supply this Government with the necessary quantities.

It must be understood that India produces more mica than any other two countries. Their mines have been largely developed with unlimited cheap Hindu labor (men, women, and children), which made it impossible for American miners to compete with this foreign product.

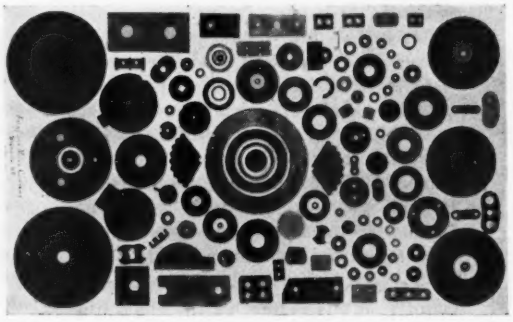
It is interesting to note the low wages that are paid in India:

	Cents per day.
Carpenters	18-23
Men coolies	12-15
Women coolies	5-9
Boy coolies	3-9
Cutters	7-14
Splitters	4-9
Sorters	9-18

These data were obtained from the United States consul at Calcutta in 1921.

The average domestic wage earners are are paid from $2 to $3 a day. From this comparison it is easily seen how the domestic industry has been handicapped.

As there is only a small tariff on mica, the industry has never had adequate protection. Notwithstanding the facts that the World War showed the importance of mica in modern industry, that the United States production had been decreasing and the imports increasing, Congress failed to raise the tariff over the previous bill.



In consequence the domestic production has decreased rapidly since 1919, and today dealers and manufacturers are more and more dependent upon foreign supplies. Until the industry receives proper protection small and intelligent mining will, no doubt, continue to some extent.

The prices for the highest quality of mica have been advancing rapidly for the last year. Unfortunately the quality is only found in deep and expensively operated mines. The domestic miner will not risk the chance of opening these mines, as much of the output is of a lower quality, which can not compete with the low prices of foreign material of like quality.

There are three distinct and highly specialized branches in the mica manufacturing industry—raw mica, micanite, and ground mica. Although the two former compete with one another as an insulator in the electrical industry, each has its peculiar use and ad-

*Asheville Mica Co.

vantage even to the point of monopoly. There are many uses indeed for pure mica sheets for which no suitable substitute has ever been found.

Large manufacturers of pure mica have several expert buyers in the field buying the output of mines, and even send experts North, South, and West to investigate any new fields of development. In order to fill the requirements of all demands, they have their source of supply also in India, Africa, South America, and Australia. Accumulating large stocks of mica of many qualities enables dealers and manufacturers to stabilize prices to the consumer and assures the filling of any order, however large, in practically the same quality.

The crude domestic mica from the mines, roughly sorted according to size, is carted to various warehouses, and from there it is shipped to the main factory in carload lots. There, under expert knowledge and workmen, thorough inspection is given every piece before being knife-trimmed or cut with shears or dies into thousands of different shapes and sizes required by the consumer.

The demand for mica by manufacturers is increasing for all lines of the electrical industry. The radio industry has created an insistent demand for large quantities of the highest quality of thin sheets. A piece of clear mica is used in each fuse plug, and so great is the demand for mica for this purpose that it is difficult to supply the requirements. The growth of the electrical heating apparatus is another demand for mica which helps to keep the industry in a flourishing condition.

About 1890 the scarcity and high price of larger sheets of mica led to the invention of built-up mica, or "micanite," as it is known to the trade. The thin sheets or splittings for this material are made from the small-sheet mica, for which there was formerly a comparatively small demand.

In making splittings the small crystals of mica are knife trimmed on a bevel and one edge pressed against a hard surface to keep open the laminations. The mica is then split with long knives into sheets varying from one-half to one-thousandth of an inch in thickness.

The splittings are then, in overlapping positions, spread over a large table. They are covered with a layer of shellac and on top of the shellac another layer of splittings is arranged. This alternating process is repeated until the desired thickness is obtained. The whole mass is subjected to a high hydraulic pressure and afterwards baked in an oven. The block is then milled down to an even and a more exact thickness.

Micanite is superior to pure mica in that it can be molded easily into various shapes. On the other hand, the dielectric strength and transparency are materially affected.

The manufacture of splittings is confined to India on account of the cheap labor prevalent. For many years splittings were made in Canada out of phlogopite mica, but this production has been practically eliminated by the discovery of phlogopite mines in Madagascar, from where the mica is sent to India to be made into splittings.

In the ground mica industry there are two distinct processes — the wet-ground process and the dry-ground process. The former grinds the material under water, thereby eliminating all the clay and silt possible. The mica is then dried slowly and bolted to the desired mesh. The finished product is very clean and has a high degree of luster. For these reasons the wall-paper trade consumes the greater portion of the wet-ground mica.

The dry-ground process requires comparatively clean refuse for its successful completion, because there is no water present to carry off the clay. The mica is not only ground but is beaten, rolled and bolted. This is necessary, because a high degree of friction is unobtainable between the flat flakes of mica and the rolling or bolting surface. The refuse is put through a series of these operations until the finished product results. The roofing and tire industries consume a great portion of this material.

The ground-mica industry has played the important role in turning the refuse into something other than mere waste. Before this industry was developed the greater part of the mine output was discarded, but now the mining industry has been augmented in that a market was discovered for the refuse.

From what has been written it is easily seen that the mica industry is one of the most important, even though small, in the United States. Unfortunately the tariff wall is not high enough to fully protect the industry, and until that protection is afforded it will be impossible to compete with the cheap foreign labor.

In view of the fact that many of the larger industries of the country had their schedule raised from 100 percent to 300 percent in the 1921 tariff bill, whereas the mica tariff was not increased at all, one is prompted to think that the mica industry was not thoroughly investigated or not considered of sufficient importance. Unfortunately for the producers of mica, their product is considered a raw material by the large consumers, and these large consumers, amply protected on their own manufactured article, desire to buy their raw material in an open world market.

CLAYS OF THE SOUTHEAST

(*Continued from page* 161)

paratively new. Much information is yet needed as to the resources, properties of the different varieties and their proper use and substitution for other clays now in use and considered essential by some manufacturers. At the present time nearly all the production is shipped to the centers of manufacture in the north and east where it meets direct competition with imported clays that are brought in, mostly from England, under a very low ocean freight rate. This applies not only to the pottery clays but those used for filler purposes which constitute a large part of the consumption. The claim of importers and some consumers that the domestic clays are inferior to the imported was formerly based on the fact that shipments of domestic clays were not always uniform and to lack of knowledge as to their proper use. These prejudices and objections are being partly overcome as the southern producer is giving more attention to the quality of his shipments and more care and skill to their preparation.

Conditions in the South are very favorable to the establishment of ceramic industries of all kinds. The climate is mild, labor is plentiful and at present comparatively cheap. Hydro-electric power is available in many districts, fuel from the Alabama and Tennessee coal fields is available and the markets for the finished product are constantly growing. Feldspar and silica are near at hand in the Carolinas, Georgia, Alabama and Tennessee. There is also a great opportunity to build up an export trade with South America through the readily accessible southern ports. For these various reasons the southern clay fields would seem to be the logical place for the establishment of a ceramic industry producing white ware, electrical porcelain, stoneware, sanitary ware, refractories and high grade brick. At present the clays and feldspar are shipped north, manufactured, and the finished products returned to the southern markets instead of manufacturing from nearby raw materials within the market.

A study of methods of improving the gravity concentration of ores and of the prevention of waste in such processes is being conducted by the Bureau of Mines, at its Moscow, Idaho, field office. A careful analysis of the subject of table concentration opened up a study that offers possibilities. Also a study of stratification proved fruitful, and new types of "fine" sand and "coarse" sand concentrations are under investigation.

SLATE—AN ANCIENT AND EXCELLENT BUILDING MATERIAL

Slate Is Steadily Increasing In Popularity And Research Work Is Developing New Uses—This Article Describes The Various Methods Of Mining And Quarrying Slate

By W. S. HAYS *

MINING operations are responsible for all or a large part of the production of most building materials none more so than slate.

In recent years, slate has steadily increased in popularity, and considerable research is being carried on to develop new and diverse uses for this unusual stone. Since the public has awakened to the appalling losses each month caused by building with inflammable materials, slate has been increasingly growing in demand.

A study of the slate industry brings out one of the most interesting romances of the industry.

An exhaustive study of the stone quarrying industries made by the Bureau of Mines and U. S. Geological Survey, has been responsible in a large measure for making available to the public, through the published reports of Dr. Oliver Bowles, T. Nelson Dale and G. F. Loughlin, the superior service rendered by slate for the many purposes for which nature has endowed it. Incidentally, these studies have promoted a better feeling through interchange of ideas of the producers, on quarrying methods, economies and manufacture and uses.

There is marked recognition of the durability and practicabilities of slate for structural purposes, its ultimate economy as compared with roofing materials that have to be repaired and replaced, its advantage and economy for electric switchboards and blackboards and other varied uses.

Slate is a sedimentary product of prehistoric geological upheaval and convulsion in the crust of the earth. It is essentially a product of nâture and therefore the inherent qualities of it cannot be changed by man. The terin "Slate" is applied to fine-grained rock that has an almost perfect cleavage, permitting it to be readily split into thin, smooth sheets. The term includes materials differing widely in color and having a mineralogical composition. Nature has selected and assorted the materials of slate more carefully than man can choose the constituents of any artificial product, and no hydraulic pressure humanly devised can approximate the mountain building forces that compressed slate into its dense compact form. While slate originated from clay, the intense pressure and high temperature have completely altered it into quartz, mica and chlorite, three of the most stable, insoluble and permanent of all minerals. As it consists of such weather-resisting natural minerals, slate is one of the most enduring structural materials the world has ever known.

To all readers of THE MINING CONGRESS JOURNAL a brief description of the various methods of mining or quarrying slate will be interesting. The National Slate Association at its recent annual conference in New York, particularly stressed the need for greater research and development of improvements in methods of quarrying. In the past two years owing to protracted strikes, new modern mills have been erected for shaping roofing slate which in most quarries heretofore had been split and trimmed in individual shanties, one crew of two or three men to each shanty. The new mills give better supervision of work, a chance to train young beginners in these tasks which for years were supposed to require qualities only enjoyed by French or Welshmen who had come to this country from abroad or which were acquired after many years of hard training in this country. In these new mills the beginners have been trained in a remarkably short time to equal and even surpass the production of the older hands.

THE MINING AND QUARRYING OF SLATE

In this article we have not attempted to picture or show any of the usual slate quarry pictures which have appeared so frequently. Those interested in studying the present methods can obtain full details from the various U. S. Bureau of Mines Publications, such as Dr. Bowles' "Technology of Slate," Bulletin No. 217.

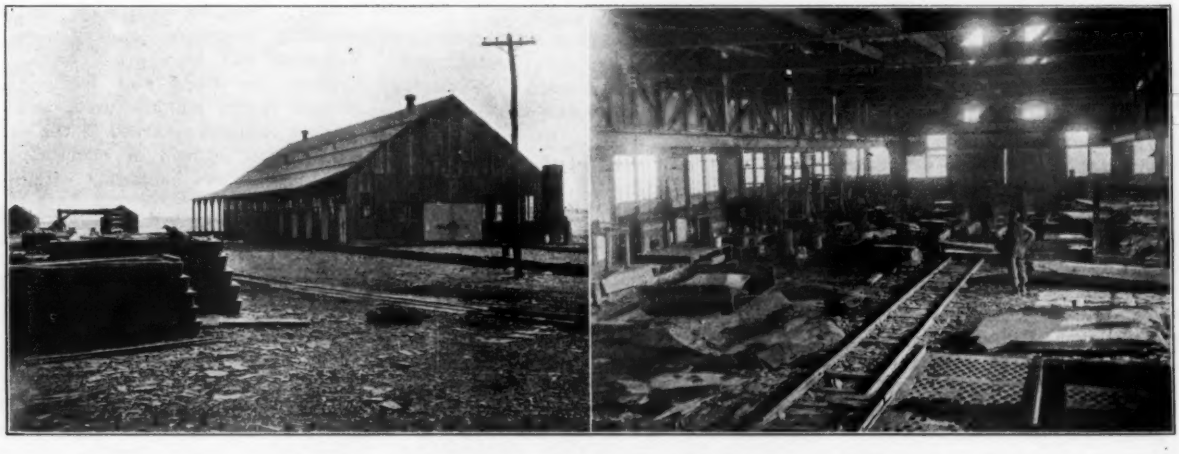
Slate is quarried by different methods depending upon the structure and bedding of the rock.

In Pennsylvania, the deposits are in nearly vertical beds, but curve back and forth at steep angles. In the New York and Vermont slate area near Granville, the bedding dips at an angle ranging from 15° to 60°, the average being between 40° and 45°. Here, therefore, the plan of quarrying is different from that in Pennsylvania.

The vertical beds of Pennsylvania permit a small surface opening which can be worked to great depth and operated for many years without the expense of removing the overburden. Where the beds are at an angle it is necessary to "strip" or remove large quantities or waste rock or earth.

The use of shafts or drifts in the

* National Slate Association.



Interior and exterior of modern mill for shaping roofing slate

Typical block from quarry before reduction to blackboard, electrical, roofing, or structural slate slab sizes

mining of slate is resorted to only where the vein is narrow and vertical or nearly so. The active slate mines of this type are now confined to the Monson District of Maine.

Here each mine demands a slightly different method of treatment, some sinking a shaft and working the roof of the drift to obtain the slate, utilizing the waste to build up the floor. Others combine this method with that of sinking the drift floor, taking slate from the floor and working down the bed.

In each, however, fullest advantage is taken of the seams, making these take the place of a channel cut wherever possible.

Hand drills, machine drills and blasting are used to some extent, depending upon the location of the bed. The use of channeling machines, run by steam or compressed air, which give a smooth surface and provide a means of obtaining regular rectangular blocks, is found in Pennsylvania quarries.

After the block is cut by the channeling machine, it is necessary to separate it from the floor. Where seams do not occur, horizontal drill holes are projected at the floor of the bench parallel to the slaty cleavage. Black blasting powder exploded in small charges then makes a fracture, separating the mass from the floor. These large masses are subdivided into slabs by splitting along the cleavage plane and can then be hoisted to the surface.

From the cableways the blocks are placed on cars at the landing and drawn to the mill or shanty. At the largest and most up-to-date quarries gasoline engines draw the cars directly into the mill. Here the slabs are lifted by electric traveling cranes and placed on saw tables where they are sawed and later "skulped" into convenient size slabs for the slate splitter.

The slate splitter, using a flexible chisel and wooden mallet, splits the slab first in the center and continues to subdivide it in the center until slate are obtained of the required thickness. The final pieces are then trimmed to commercial size either on a foot treadle machine or by a mechanical trimmer, and hauled to the storage yards and piled on edge, each pile being made up of slates of the same size. Slates are sometimes punched before piling; at other times just before shipment, and sometimes on the job. So much for roofing or quarry cleft surface. Mill stock surface slabs are sawed, planed, rubbed and polished even to a honed surface. A recent development has met the desire for lighter colors by finishing structural slate in white or any color.

The National Slate Association will welcome any suggestions from readers of the Journal, as to methods which might improve quarrying of slate or reduce costs of so doing.

THE GYPSUM INDUSTRY

(*Continued from page* 156)

reduction. Less than 10 percent of the calcined gypsum manufactured in the United States is treated in this way. Rotary calciners for gypsum are seldom more than 120 feet in length and are carefully designed for temperature control to avoid dead burning, which is fatal to quality in calcined gypsum.

The ordinary calcining apparatus is the so-called "kettle." This consists of a vertical sylinder with four horizontal flues and a fire-box and baffles so constructed that very little direct heat strikes the concave bottom, the heat being transmitted to the gypsum through the sides of the kettle and the flues. The calcining kettle is usually 10 or 12 feet in diameter and 10 feet high. It is fitted with a mechanical agitator, which constantly changes the material that is in contact with the heated surface. For kettle calcining the gypsum is first ground so that 85 or 90 percent will pass a 100 mesh screen. For most purposes the gypsum is discharged from the kettle when the temperature reaches 340 degrees F. When discharged at this temperature the gypsum is in the form of the semi-hydrate commonly known as plaster of paris. For some purposes a higher calcination temperature, 390 degrees F., is used, the gypsum discharged at this point containing considerable quantities of soluble anhydrite. It possesses higher tensile and compressive strength but is less plastic than gypsum calcined at the lower temperature. Where maximum plasticity is desired the gypsum is sometimes reground after calcining in a ball mill from which air currents are largely excluded.

Calcined gypsum used in the manufacture of wall plaster is retarded so that it has a setting time, when mixed with two parts of sand, of four to eight hours. This is done in order to give the plasterer ample time to mix and apply the mortar. The retarder, which is prepared by three or four firms who specialize in this line, consists essentially of hair and hoofs reduced by caustic lime, and definite amounts of hydrated lime and clay. Fibre, either in the form of hair or shredded wood, is added, not to increase the tensile strength, but to prevent an excessive amount of the mortar from passing through the spaces between the laths or the holes in the expanded metal at the time of application.

The growth of the gypsum wall board industry during the last 10 years has been remarkable. Gypsum boards fill a definite place in building construction, and do not enter to any great extent as a competitive material with gypsum plasters. Gypsum tile for non-bearing partitions compete successfully with clay tile except in localities where clay tile have an advantage in freight rate. Structural gypsum, either precast or poured in place, is receiving more recognition each year for roof and floor construction. Its lightness and lower heat conductivity give it certain advantages over concrete.

Much new capital has gone into the gypsum industry during the past ten, and particularly during the last five years. Old companies have expanded and new companies have been organized, until there is definite danger of overexpansion. This condition will probably manifest itself as soon as the peak of the unusual activity still characterizing building construction is reached. This time is evidently not far off.

ECONOMIC GROWTH OF THE SOUTH

The South Stands On The Threshold Of Great Industrial Development—Her Vast Resources Of High Grade Minerals Are As Yet Almost Entirely Undeveloped—What Leaders In Industry Predict For The South Outlined

By DUNCAN U. FLETCHER *

IN 1909 an Altruistic Central Agency, founded on public spirit, was organized for the purpose of serving the South primarily and concurrently the Nation.

It began functioning in February of that year, with headquarters in Washington. Its conception originated in the thought that a union of effort was required, first, to induce a proper understanding by the people of the South regarding the significance of the physical resources of their states, and the possibilities in their fruitful use. And, second, to sweep out of the mind of the world elements of misunderstanding regarding the South, its prospects, its people, and its opportunities.

The work undertaken was to change men's minds regarding the South, its improvements, potentialities, and advantages; minds that needed enlightenment, and our method was the reiterated declaration of the truth about the South and existing conditions. Its chief efforts were directed to broadcasting the truth, and its slogan was "A Greater Nation Through a Greater South."

John M. Parker, afterwards governor of Louisiana, was its first president. In March, 1911, I was chosen to succeed him, and on account of the press of public business was compelled to sever my connection with it in 1918.

It had a great convention in Atlanta, March 8 to 11, 1911, and the proceedings, with the principal addresses, were published in a volume of 1,064 pages entitled "The South's Physical Recovery."

From a few of these addresses I wish to quote briefly.

William H. Taft, then President of the United States, said:

"An examination shows that proportionately the commercial and business growth of the South is greater than that of any other part of the country. A cotton crop that sells for a billion dollars insures prosperity, and when, in addition to that, you raise a corn crop worth half a billion dollars, and include the tobacco you raise, the product of your iron industry, your cotton manufacturing, and your truck gardening, as well as the naval stores of the Carolinas and Georgia, and the sugar and rice of Louisiana and Texas, the fruits, and the lumber of all the Southern states, one begins to get a conception of the marvelous progress of the South."

Theodore Roosevelt, former President of the United States, said:

"I look to see in the Southern states, within the next half century, a development unparalleled in any other portion of our great land."

Woodrow Wilson, the next President of the United States, said:

"I have listened to many comments upon this great gathering, and I have heard it spoken of as a symptom of the 'awakening of the South,' but I don't think that the South has been asleep."

Senator Duncan U. Fletcher

James Wilson, then Secretary of Agriculture of the United States, said:

"If the South will produce everything she consumes, when the billions of dollars worth of cotton that is grown in the South is cashed annually, then all of it will be retained within her border, because she is complete in every respect, and the billion of dollars that comes to her farmers annually means a billion dollars wealth every year.

"The South, with the wealth that must come to it if you follow the economic lines with your characteristic energy, will soon be living in a period of prosperity undreamed of by the preceding age.

"In the older Southern States only about one-sixth of the land is under cultivation. This one-sixth has to carry on all the functions of civilization, and in addition pay taxes on the five-sixths that is unused. You can easily double the production of the one-sixth now used, and it will enable the South to use the other five-sixths to supply and make prosperous twelve times the population she now has, so that for a number of centuries there need be no fear in the Southern States that there will be a lack of land for homes and a lack of soils to produce the food for the people."

Jacob McG. Dickinson, then Attorney General of the United States, said:

"The tremendous and steady strides being made generally in the South for successive decades, in education, commerce, manufacturers, mines, bank capital, railroads, agriculture, indeed in all that indicates steady progress, demonstrate that the people of the South, taken generally, are peaceable and law-abiding. The increase in taxable property in 20 years has been over seven billions of dollars."

Joseph M. Brown, governor of Georgia, said:

"Georgia was the first to establish a state university. The first to apply steam to navigation. This was done by William Longstreet on the Savannah River in 1790. The first to send a steamship across the Atlantic Ocean. The first to codify the English law. The first to discover anaesthesia, this having been done by Dr. Crawford W. Long."

David R. Francis, former governor of Missouri, Secretary of Interior, and later ambassador to Russia, said:

"It is only within the past 30 years that the South has begun to recover from the blight put upon its commercial development. Its progress during that period is wonderful to relate, wonderful because in itself enormous, and more wonderful because it has more than kept pace with the incomparable progress of the entire country.

"The South is not only an area of land permeated by great rivers, traversed by great transportation lines, dotted with flourishing cities and blessed with great natural resources, it is an idea—an ideal."

Arthur M. Harris, of Harris, Forbes & Co., New York City, said:

"I firmly believe that the material and industrial progress of the South during the next 20 years will equal, if not exceed, that of any other section of the United States. * * *

"From the standpoint of productiveness the cheapest land in the United States today is to be found in the South. Agriculture remains the greatest economic interest of southern life, and while

*United States Senator from Florida.

there has been a considerable advance in prices during the last few years, there has been little inflation as the result of speculation. The large influx of population from other states and other nations, together with the general movement toward the diversification of crops, will prove powerful factors in maintaining legitimate land values. I thoroughly agree with Richard H. Edmonds that: 'No other section of the country equals the South in the aggregate of its natural advantages for agriculture, for manufacture, for mining, and as a place of residence. It has all of the primary elements of attraction for men who wish to gain wealth or make homes. With millions of acres of fertile lands awaiting the plow, with billions of tons of coal, iron ore, phosphate rock, sulphur, and other minerals to be taken from the earth, and with its teeming opportunities for enterprise and energy, the South incites to investment, the mind, the muscle, and the money of the world."

R. L. McKellar, assistant freight traffic manager of the Southern Railway, in discussing transportation, said:

"(1) The distance from the Canal to these South Atlantic and Gulf ports is less than to any other ports in the United States.

"(2) The greatest variety of commodities are produced and consumed in the 16 Southern States.

"(3) The facilities, both rail and water, for transporting these commodities to south Atlantic and Gulf ports are all along the lines of least resistance.

"The 16 Southern States embraced in the Southern Commercial Congress represent 27 percent of the total area of the United States. These same 16 states are served by 80,000 miles, or practically one-third of the total railway mileage of the United States, and its total population is also approximately one-third that of the United States. Extending from Corpus Christi, Tex., around the Gulf coast to Key West, thence up the Atlantic to Baltimore, a distance of 2,500 miles of coast line, are found 16 well-established ports with safe harbors and a sufficient depth of water to accommodate large ocean-going vessels. At these 16 ports terminate railway mileage aggregating around 80,000 miles, or about one-third of the entire railway mileage of the United States.

"In addition to the 80,000 miles of railway referred to as serving south Atlantic and Gulf ports, there can safely be added 20,000 miles of additional railway mileage in the nature of connecting lines, giving in the aggregate 100,000 miles of railway mileage engaged in transporting products of mines, forest, field, and factory along the lines of least resistance to the ports served by the several carriers comprising this total mileage. In addition to this total railway mileage, the number and mileage of navigable streams in the United States by districts are as follows:

	No. of streams	Navigable length, mi.
Tributary to Gulf of Mexico, exclusive of Mississippi River and tributaries	53	5,212
Mississippi River and tributaries	54	13,912
Tributary to Atlantic Ocean	148	5,365
Tributary to Pacific Ocean	38	1,606
Flowing into Canada	2	315
	295	26,410

"Seventy-five percent, or something like 22,000 miles, terminates or reaches the ocean at southern ports, and 19,000 miles, or something over two-thirds of the total, terminates at Gulf ports.

"This substantial water mileage, terminating so largely at Gulf ports, exerts both active and potential competitive force, both in the way of affording transportation along the line of least resistance and in the establishment of low rates."

George Westinghouse, inventor and manufacturer, of Pittsburgh, Pa., said:

"In the development and utilization of the energy of waterfalls the South has already taken a leading position, and the industrial benefits thereof are so widely and favorably known that no argument is now needed to justify the work already done or to point out the great and lasting benefits to be derived from its extension. * * *

"The industries most likely to be developed and to increase because of peculiar suitability to conditions now existing in the South are: Textile mills, fertilizer works, cement plants, coal, iron, copper, and gold mining, ore-reduction plants, iron and steel mills, agricultural implements works, canning factories, road building, furniture manufacture, lumber plants, paper mills, shoe and leather factories, and oil refineries, in all of which industries electric power increases production."

Although interesting statements must be omitted, I have given the extracts from addresses delivered at the armory in Atlanta to large audiences over 14 years ago for two reasons: First, they are the expression of the views of some of the ablest and most far-seeing men in the country respecting conditions and possibilities in that region called the South, commercially, industrially, and economically, as they saw them in 1911.

Second, they evidence the fact that the misapprehensions and lack of understanding previously existing regarding the opportunities and advantages to be found in the South were being then permanently swept away, and the truth respecting the South was beginning to appear and spread, and that the movement southward had then set in earnestly and in volume, thus showing that the present hegira from all portions of the country and from other lands is not an ephemeral, irrational, temporary affair, based on speculation or a financial debauch, but represents a studied, carefully worked out purpose, founded on actual knowledge of conditions and search for sound investments.

The object in the minds of those moving South is to change their place of abode, make their investment and their homes in this new field, among the sunny-hearted people of this sunny land.

The veritable tidal wave sweeping over Florida, for instance, is found in the realization that the things the coming people want can be found there and no where else. This is a permanent, not a temporary, passing state of mind and purpose.

This movement began some 15 years ago and has been growing steadily, while transportation facilities have been improved and extended, good roads have been constructed, hitherto unknown, and attractive regions have been made accessible, and the use of these has contributed to swell the immigration to unprecedented proportions. It can not be checked, and it will last, because there is nothing required by man or beast but what can be furnished and provided in this region under healthy, comfortable, happy conditions, and the population of these 16 Southern States may well be doubled and supported at home.

Florida, with a population of a million and a quarter, can easily take abundant care of five to ten times as many.

Trading in land, speculation, buying for purposes of selling, dealing in property, the prices of which have been ridiculously low heretofore, and the advance of these prices to approaching real values, may well be expected.

But the millions of dollars brought into Florida during recent months were brought there in the main for investment, for development, for constructive enterprises, and for homes.

The present building program, the letting of contracts it will require years to complete, totaling many millions, give evidence of permanent growth rather than the existence of a "bubble" or "boom."

The South was prostrated by the war in 1865. These 16 states began to breathe freely and see clearly in 1876. By 1880 they were permanently planted on firm, mostly new ground. Asking no favors, but with the courage and self-reliance which always characterized her people, she moved forward in the development of her vast natural resources, in agriculture, commerce, and manufacturing as well. That advance, checked now and then by adverse conditions, followed by a more rapid stride in the next bound has been a steady climb upward toward the high plane "where shines unobstructed the light of the justice of God."

We have seen by the utterance of eminent author- (*Continued on page* 177)

DEVELOPING THE FLUORSPAR INDUSTRY

Ninety Percent Of Fluorspar Produced Is Used As Flux For Steel—Use In Iron Foundries And Chemical Manufactories Increasing—Adequate Tariff A Necessity To Life Of Industry

By JAMES A. GREEN *

THE United States Tariff Commission has ordered a hearing on the question of the tariff on fluorspar. At the present time the Commission is making its own field investigation to determine the cost of production and to gather other information that may bear upon the subject. Some weeks will elapse before this field investigation is completed, the government data assembled, and the date of the hearing announced.

Domestic producers of fluorspar complain that foreign producers are flooding the country with imported material. Furthermore, they believe that the existing tariff offers no adequate protection as the cost of the foreign fluospar, plus the duty, is less than the cost of production in America. Certainly with no increased consumption of fluorspar in America, imports have grown amazingly. The record of imports is as follows:

1921	5,562 tons
1922	29,561 tons
1923	87,396 tons
1924	45,376 tons
1925	48,482 tons

Apparently steel makers abroad are not as busy as in prewar years. They are not using the tonnage of fluorspar they formerly used and it is being dumped in America by the wholesale. It is being carried across the Atlantic at practically ballast rates. Ships westward bound are glad enough to get heavy bulk tonnages and make very low freights on such business. This foreign ore is produced by miners who are paid only a fraction of the wages paid American miners. On the face of it, here is a case of the most extreme kind of unfair competition. This competition is of such a drastic and unmeetable variety that American producers have lost more than half their market. From Pittsburgh east the foreign producer is in control of the market. The price he is able to make in that territory cannot be met by the American producer. He is simply up against it. Half of his potential market is gone. He is compelled to pay higher wages than ever before; his railroad rates to the small market he has remaining are nearly twice that of 10 years ago; his dynamite costs more money; his drills, hoists, trucks and all the tools and materials he uses have largely increased in price. He is absolutely unable with this state of affairs to reduce his cost and has been obliged to stand idly by and see the foreign producer ruin his industry. The consequence has been a great shutting down of American mines and a partial paralysis of the fluorspar industry.

The proved area in which fluorspar is found in the United States is limited—it centers around Marion in western Kentucky—a few counties there and a few counties on the other side of the Ohio River in southern Illinois. There are a few mines in Colorado which supply the far West, and from time to time there have been stories of gigantic veins in Nevada. But these are remote from railroads and even if on the railroads they are remote from the places where fluorspar is consumed. It may be that Nevada has immense reserves of fluorspar, but at present for all practical purposes the only fluorspar that is readily available is found in western Kentucky and southern Illinois.

More than 100 years ago these fluorspar outcrops were worked. The early miners were after lead and fluorspar was not even a by-product, it was pure waste. The lead now is a by-product, although one of great value.

Veins of fluorspar vary in width from a few inches to as much as 14 feet. They are never regular, and have solid rock walls on either side. Many mines are absolutely clean, pure crystalline fluorspar between the clean rock, but occasionally there are deposits of mud which have filtered down, so that the ore must be washed. There is great variation in the quality; some of it is almost chemically pure, some shot through with lead which necessitates crushing and jigging to separate the lead from the fluorspar; some has talc incorporated with it; some is so infused with the side walls that it cannot be mined cleanly and parts of the rock walls come with it. Near the surface is to be found fluorspar and rock which have disintegrated and are mixed together in a grand jumble with clay. This surface ore is frequently of the best quality but it takes a great deal of washing and treatment to recover it.

The ordinary method of mining is to sink a shaft through the rock alongside the fluorspar, cutting a horizontal tunnel to the vein. Levels are then in the vein and the ore is mined by a series of stopes. Some of these shafts are 800 feet deep. The fluorspar at that depth is the same in quality as at the upper levels. How deep the ore may go has not been determined as no shaft has yet been sunk deep enough to come to the place where it ceases. Geologists believe that the ore extends to a depth of some 1200 feet and that below that zinc takes its place.

The mining of fluorspar is not a cheap process. Many of the best veins are situated a long distance from the railroad so that the ore must be hauled before it can be shipped.

The United States Steel Corporation is one of the newest producers in the Marion field. It has done much deep core drilling. This company has paralleled its property with a railroad and in addition has built a mill of great size. It is evident that the corporation has not only provided itself with fluorspar for the present but has also provided itself with an immense reserve for the future; and, in view of the limited area in which this ore is found, the wisdom of the corporation in thus making itself independent of the fluctuations of the market is apparent. The Aluminum Company also has extensive holdings and a very fine mill. Its investment like that of the steel corporation runs into the millions. The Rosiclaire, Fairview, Kentucky, Fluorspar, the Holly Company, the Hillside Fluorspar Company, the Kentucky Fluorspar Company, the Roberts Company and the Douglas Company are among the other large producers in the fluorspar country.

At least 90 percent of all the fluorspar produced is used as a flux for steel, made by the open hearth process. For steel uses it is crushed to what is called "gravel" but oftentimes this gravel is almost like coarse sand. The usual steel specification is:

Not less than 85 percent Calcium Fluoride; not more than 5 percent Silica.

The use of lump fluorspar by iron foundries is increasing. Iron smelted with 80 percent good limestone and 20 percent fluorspar is vastly cleaner and better than iron fluxed with limestone alone. Many of the up-to-date foundaries making high grade castings use fluorspar. Makers of radiators, engines, etc., find it of great advantage, and the more progressive of the machine toolmakers are using it. If it were used in every iron foundry in America, the result would be castings vastly better than is the present average. In the manufacture of aluminum, fluorspar plays an important part.

Ground fluorspar—that is, a high

* Cincinnati, Ohio.

grade ore ground as fine as wheat flour —is being used more and more by pottery and glass makers. There is an immense field for its exploitation in the ceramic and allied industries. From it is produced shades for electric lights that cannot be excelled.

Fluorspar is also employed by the chemical manufactories. Chemical ore must be pure, 98 percent or better. Then there is optical fluorspar. It is made into lenses but its use for this purpose is so limited that it would be difficult to find a fraction small enough as compared with the total production to express it. Only now and then is found a crystal of fluorspar large enough and pure enough to serve for optical purposes.

When fluorspar is ground it is white, yet the ore itself comes in various hues. Usually it looks like more or less clear glass, but frequently it is as purple as an amethyst or has the soft yellow of a topaz. Selected crystals might be classed as diamonds, amethysts or topaz. The fluorspar used in the ceramic industry is not shipped except in the ground form. And for grinding, ore of high quality is necessary. Excess talc, silica or lead is not permitted. In the past few years new uses have been found for fluorspar and it is most likely that in the arts and industries it will be employed in many ways which are not now known.

One of the largest of the companies mining fluorspar is proposing to sell it on the basis of analysis just as pig iron is sold. At present each kind of ore is sold on a general guarantee of quality. This company takes the ground that all the consumer wants is calcium fluoride and that the more calcium fluoride there is in the ore the more it should be worth. And it suggests that all fluorspar be sold on the unit of C. F. That is, for example, fluorspar should be quoted at 25c per unit of C. F. If it contains 90 percent the price would be $22.50 per ton. If it contained only so on. As it is now under the general specification of not less than 85 percent of C. F. or more than 5 percent of silica, the buyer has no particular advantage and certainly the seller has no inducement to ship higher grade material. On the face of it there seems to be no room for argument. The richer the fluorspar the more it should bring and the buyer would pay for what he got—if he got poor fluorspar he would pay a low price, if he got rich fluorspar he would pay a high price, but he would get value received for his money, which may not now be the case.

Fluorspar from the western Kentucky and southern Illinois field is produced under American conditions. American wages are paid and American standards of living prevail. Cheap foreign labor and the dumping of foreign ore on the market is a serious menace to the American industry. We can supply all the fluorspar that the industries of America demand but it is difficult to compete against the foreigner who pays less than a third of the wages paid here.

GROWTH OF SOUTH

(*Continued from page* 175)

ities that the growth and prosperity of the South is not of some recent origin. Existing conditions prove their predictions were correct. This unfolding, this achievement, has been a continuous process, and the progress experienced rests on permanent foundations.

A few facts may be stated as proofs:

Population has increased from 18,538,340 in 1880 to 37,686,370 in 1923.

Estimated values of property has increased from $9,177,000,000 in 1880 to $71,375,367,000 in 1923. The aggregate wealth of the Southern States has multiplied sevenfold since 1880 and fourfold since 1900.

Total bank deposits increased 233 percent between 1910 and 1923. Total resources of national banks gained 543 percent. The value of farm products has increased more than 300 percent in the past 20 years.

In 1880 there were 24,866 miles of railroad in the Southern States. Today the mileage is 90,325. The value of foreign commerce through southern ports was six times as great in 1923 as in 1880. For the year 1924 Texas led all the states of the Union in exports. Last year 38 percent of all the country's exports originated in the South. The Southern States are now producing 29 percent of the Nation's corn, 85 percent of its tobacco, 17 percent of its wheat, 83 percent of its rice, 31 percent of its fresh vegetables, 50 percent of the total lumber output, her forests providing annually 15,000,000,000 feet; practically all of the cotton, valued annually at $1,720,000,000 and being 60 percent of the entire world production; all of the naval stores, turpentine and resin; all of the phosphate, Florida alone producing 87 percent of that. Her output of coal in tons has multiplied twenty-eight times since 1880, being 178,061,001 tons in 1920. Her mining products in 1923 were valued at $1,127,574,868. In 1880 the South yielded 179,000 barrels of petroleum; in 1923, 365,000,000 barrels, one-third of the world's production. The output of iron ore has been increased sevenfold during that period. Production of sulphur has increased from 3,000 tons in 1900 to 2,000,000 tons in 1923. She produces 80 percent of the country's china clays, besides abundance of Fuller's earth and numerous lesser clays, together with lime rock, cement, marble, and other building materials.

The last general census of 1919 showed 66,500 manufacturing establishments, with a combined capitalization of $6,883,000,000. The establishments engaged in manufacture of cotton goods, cotton lace and cotton small wares in 1919 numbered 1,642, with capital invested in them totaling $878,629,377.

These statistics might be greatly extended.

Florida alone has a coast line equal to one-seventh of the total mileage of the 19 states bordering on salt water. I would like to dwell on the resources and attractions of this mother of America. There is but one Florida.

The South has always favored education, public, and private and thorough. I have space only to give the figures, which speak for themselves. Public-school expenditures in 1880 amounted to $12,471,000. In 1923 the sum reached $315,915,000. The economic development of the South has been most gratifying, but it has just begun.

Near Washington on the old Chesapeake and Ohio Canal

The Department of Labor has issued a report on wages and hours of labor in bituminous mining in 1924, covering mines in Alabama, Colorado, Illinois, Indiana, Kansas, Kentucky, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.

THE REVENUE ACT OF 1926

The Repeal Of The Capital Stock Tax And The Clarification Of The Discovery Depletion Provision Of The Bill Are The Outstanding Features Of New Law As Affecting The Mining Industry—New Machinery Provided That Will Simplify Procedure

THE Revenue Act of 1926 repeals the capital stock tax, clarifies the discovery clause of the depletion section, creates the office of general counsel for the Bureau of Internal Revenue and provides for four assistant general counsel, creates a joint Congressional committee on internal-revenue taxation, reinstates amortization claims that were held up by the decision of the Board of Tax Appeals in the case of the Stauffer Chemical Company, and makes a number of changes with respect to claims for credit and refund, interest on deficiencies in taxes, procedure before the Board of Tax Appeals, appeals to the courts, etc., that are of more or less importance to the mining industry on account of the fact that so many thousands of tax cases are still pending from prior years.

The repeal of the capital stock tax was urged by the American Mining Congress and its general tax committee, and a brief against the tax was presented to the Committee on Ways and Means of the House by representatives of the organization. It was urged that the tax was unscientific and offended all the settled canons of taxation in that it levied an unjust burden on mining enterprises in the development stages; that it was uncertain; that it was not easily or cheaply collected; that it offended all principles of equality and uniformity. The repeal of this tax will relieve mining companies of a considerable expense for corporate accounting imposed by the necessity of filing reports on the basis of two different accounting periods.

Depletion

On account of difficulties in the administration of the discovery depletion provision of the law in the case of oil and gas wells, an amendment was adopted which provides that in the case of oil and gas wells the allowance for depletion shall be 27½ percent of the gross income from the property during the taxable year, subject, however, to the limitation that such allowance shall not exceed 50 percent of the net income computed without deducting depletion. Some consideration was given to the question of placing mine depletion on a percentage basis; but brief discussion made it apparent that a percentage could not be agreed upon which would be acceptable to all branches of the mining industry. Short-life lead and zinc mines would be entitled to a higher rate than long-life copper and iron mines; coal mines would require a different rate from metal mines; and the possibility of securing an adequate rate for each class or group was so slight, and the danger of jeopardizing the principle so great, that the subject was dropped.

The investigation of the Bureau of Internal Revenue by the so-called Couzens committee had developed the fact that numerous discovery claims had been allowed the oil industry, while in the case of the mining industry only 25 or 30 claims had been allowed. Allowances to the oil industry were strongly criticised in the majority report of the committee. It was charged that discovery depletion allowances to the oil industry were excessive, while those of the mining industry were almost negligible. Reported estimates of the amount of discovery depletion allowed oil wells has been questioned. In any event, the new law is intended to reduce the aggregate depletion allowance to the oil industry, and to increase slightly the aggregate allowance for discovery depletion to the mining industry.

Mineral Discoveries

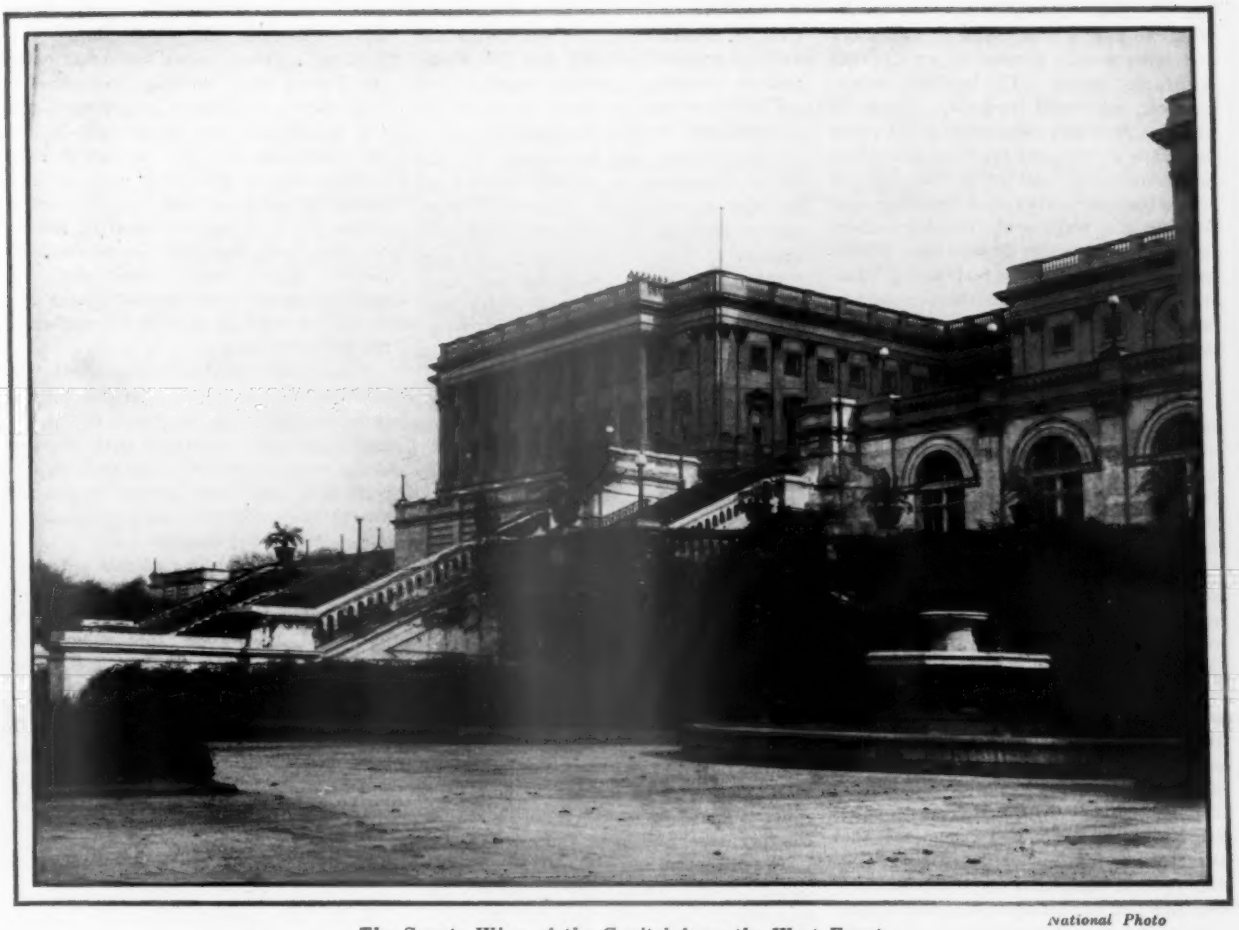
The administration of the discovery depletion provision never has been satisfactory either to taxpayers or to the income tax unit. Differences of opinion among the valuation engineers of the mining section of the income tax unit, as well as between the engineers and representatives of the taxpayers, operated to prevent the proper application of the law to mineral discoveries. The departmental interpretation that finally prevailed so circumscribed the law that it applied only to a few isolated cases where discoveries were made in tracts on which practically no mining operations had occurred. The Department in 1924 attempted to correct this injustice by an amendment to the regulations which permitted the allowance of discovery value in the case of "one or more separate new ore bodies which have not been and could not have been included in any prior valuation."

The new law provides that discoveries shall include minerals in commercial quantities contained within a vein or deposit discovered in an existing mine or mining tract by the taxpayer after February 28, 1913, if the vein or deposit thus discovered was not merely the uninterrupted extension of a continuing commercial vein or deposit already known to exist and if the discovered minerals are of sufficient value and quantity that they could be separately mined and marketed at a profit.

It is a well-known fact that old mines in California, Colorado and Nevada have recently been opened up and in many cases new and valuable ore deposits discovered therein. It is clearly the intention of Congress that this provision should extend to such ore deposits since they are true discoveries having no relation to or connection with the ores previously extracted from these mines. In the case of an interrupted or separate vein or other formation, where, by reason of faults, dykes, or displacements, or lack of mineralization, the vein or deposit could not have been known to exist except through prospecting, exploration and discovery, discovery value should be allowable, and is as fully justified as in the case of a discovery of mineral in so-called virgin territory.

New Offices Created

The American Mining Congress tax committee recommended to the Committee on Ways and Means that a special "clean-up" commission, of limited life, be created with full powers to levy, settle, adjust, and/or compromise back tax cases that have accumulated over the war and early post-war years and remain in an indeterminate state. Mr. A. W. Gregg, Solicitor of Internal Revenue, submitted to the committee a report on the status of the work of the department and its plans for cleaning up old cases. As the result of discussions in the House and Senate committees, the new law creates the office of General Counsel for the Bureau of Internal Revenue and provides for four assistant general counsel to aid in the adjustment of controverted cases. This does not adequately provide the administrative machinery necessary to clean up the congestion in the department; but it is a step in the right direction. The new law also creates the offices of assistant to the commissioner and special deputy commissioner, with salaries that are more nearly commensurate to the duties to be performed by these officers than the salaries that have been allowed heretofore for similar positions in the bureau. This also will be a help, as it should lessen the loss of key men in the bureau due to resignations to accept more lucrative positions with private concerns. (*Continued on page* 187)



National Photo

The Senate Wing of the Capitol from the West Front

LEGISLATIVE REVIEW

Congress In Mid-Session Activities Passes Tax Revision And Reduction Law With Record Speed—Coal Legislation On Program—Blue-Sky Bill Hits Snag—Bill Restricting Mining On Forest Reserves Introduced

CONGRESS has been forging ahead at top speed. The session has been marked by such great activity as to force the Senate to hold night sessions and to require numerous congressional committees to prolong their daily meetings into the evening hours. Congress established an unusual record for dispatch of public business when it passed the tax revision bill through both Houses in slightly over two months. When it is considered that this measure had to receive extensive consideration in the Ways and Means Committee of the House and the Finance Committee of the Senate, and in addition that it had to run the gauntlet of considerable debate and in some instances to meet opposition from various sources, the disposition of the bill in this short length of time establishes a record. In speeding the bill through, Congress was actuated by a desire to enact the measure before March 15, when income tax returns are filed, in order that the country might benefit by the reduced rates of taxation carried in the bill on 1925 income.

The mine depletion section of the revenue law was subjected to strong fire but was continued in the law. The attack was leveled by Senator Couzens, Republican, Michigan, who as chairman of the committee which investigated the Internal Revenue Bureau, sought to abolish the depletion allowance or to restrict its application. The mine depletion section was strongly defended by Senators Watson, Indiana, and Ernst, Kentucky, Republican members of the committee, in a minority report, which was read to the Senate by Senator Ernst. Democrats as well as Republicans rallied to the support of the provision, with the result that the opposition was unable to materially modify the law. In fact, the Senate went a little better than its finance committee, when it increased the oil depletion allowance from 25 percent to 30 percent of gross income. This was reduced by the conference committee to 27½ percent. The conference committee report was adopted by Congress and the bill sent to the President who signed it February 26, putting the law into effect.

The past month was marked by sporadic agitation for coal legislation to meet the shortage caused by the strike, but the only legislation passed was a resolution by the Senate, at the continued persistence of Senator Copeland, Democrat, New York, which requested

the President, "at such time as he thinks best," to call a conference of operators and miners with a view of settling the anthracite strike. The administration, however, continued its policy of non-interference, which was eventually justified when a few days later the operators and miners got together at Philadelphia and settled the strike on a five-year contract at the wage scale existing before the strike began last September. House leaders were kept busy restraining eastern members from insistent demands for Government intervention in the strike.

Coal Legislation

Now that the anthracite miners are back on the job, Congress may consider some general legislation intended to meet future tie-ups in the coal industry. The measure toward this end which has attracted the most attention was proposed by Senator Robinson, Democrat, Arkansas, and was also introduced in the House by a large number of members. This bill, which is being considered by a subcommittee of the Senate Committee on Labor, would authorize the President or Congress to declare an emergency respecting the distribution of anthracite or bituminous, and would empower either to call in session a board of industrial adjustments to settle the dispute. This board would consist of the Secretaries of Labor and Commerce, the Director of the Bureau of Mines, and two persons appointed by the President who are not financially interested in the coal industry. This board would attempt to conciliate the differences, encourage arbitration, and recommend processes and methods by which the cause of the dispute might be terminated. It could also investigate and report concerning the practices of coal dealers and suggest methods to protect consumers from extortion and oppression during the emergency.

The Denison blue sky bill, which mining interests contend will be destructive to this industry, received unexpected but telling opposition from the administration in the form of a protest by Secretary of the Treasury Mellon. This bill is on the House calendar subject to consideration, but the unfavorable views of the Treasury Department are expected to be an influential factor in its defeat.

Mine Bills

Restriction of mining on national forests has been proposed by the forest service of the Department of Agriculture. A draft of a bill which would curtail mining activities in the forests was sent by the department to the Senate Committee on Public Lands. No senator on that committee, however, has cared to sponsor the bill and it remains in a nebulous state. In order to obtain the views of the mining industry on the proposal Senator Stanfield, Republican, Oregon, chairman of the committee has had the proposal printed and distributed and is receiving protests against the legislation, which is likely to cause the committee to discard the measure.

Consideration has been given by the House Committee on Mines and Mining to bills to establish additional mine rescue stations in Kentucky and Arkansas.

While proposals designed to check mine drainage into public streams continue to be offered, Congress is withholding action pending a report from the War Department which last year made an extensive survey of the pollution question. This report is not likely to be presented until spring.

To meet the situation created by overproduction of oil, bills have been introduced to curtail additional leases on the Osage Indian Reservation in Oklahoma. Bills have also been introduced to extend oil and gas prospecting permits for two years in cases where the holders have been unable to perform drilling operations as required by law. One of these measures has been passed by the Senate.

Further tariff proposals continue to be presented to Congress. Among these were measures to impose a duty of 6 cents a pound on copper, and to reduce the iron, steel and metal duties.

The proposal to lease the Muscle Shoals nitrate and power project is now before the Senate, this measure having been previously passed by the House.

With the major legislative program completed—the tax revision bill—Congress will devote the remaining weeks of the session to committee consideration of various proposals and to disposition on the floors of the Senate and House of miscellaneous legislation of a general though not highly important character. Congressional leaders hope the session may be terminated early in May or June, and as there are no particularly important national or controversial political matters pending, this hope may be realized.

Mining in National Forests

The proposal of the forest service to restrict mining in national forests is as follows:

"That hereafter mining locations made under the United States mining laws upon lands within a national forest shall confer on the locator no right to the surface of the land covered by the location other than the right to occupy, under the rules and regulations relating to the national forests, so much thereof as may be reasonably necessary to carry on prospecting and mining and shall not authorize the taking of any resource other than the mineral deposits, or the occupancy of the land, for any purpose other than prospecting and mining.

"That a patent issued hereafter under the United States mining laws affecting land within a national forest shall convey title to the mineral deposits within the claim and the right, subject to rules and regulations governing such national forest, to occupy so much of the surface of the claim as may be required for extracting and removing the mineral deposits. Every such patent shall expressly reserve to the United States title to the surface of the land included in the claim or claims.

"That valid mining claims within the national forests existing on the date of enactment of this law and thereafter maintained in compliance with the law under which they we. e initiated may be perfected under this law or under the law under which they were initiated, as the claimant may desire.

"That the provisions of this act shall not extend to the Territory of Alaska."

H. R. 6261. Passed by the House. This bill authorizes the exportation from a state of timber cut on national forests or on public lands in Alaska.

Mine Station

H. R. 9000. Introduced by Mr. Ragon (Dem., Ark.). Referred to the Committee on Mines and Mining. This bill proposes to establish a mine rescue station at Spadra, Ark.

Mine Leases

H. R. 7752. Introduced by Mr. Leavitt (Rep., Mont.). Reported by the Committee on Indian Affairs. This bill authorizes the Interior Department to lease at public auction for mining purposes, land on Indian reservations set aside for agency or school purposes.

S. 2710. Introduced by Mr. Harreld (Rep., Okla.)., by request. Referred to the Indian Committee. This is similar to the foregoing.

Grazing Districts

H. R. 7846. Introduced by Mr. Colton (Rep., Utah). Referred to the Committee on Public Lands. This bill establishes grazing districts, but gives the right to mine and prospect for minerals on such lands, and the use of water on public lands in the districts for mining purposes.

H. R. 9458. Introduced by Mr. Haugen (Rep., Iowa). Referred to the Committee on Agriculture. This is similar to the foregoing.

Convict Mine Products

H. R. 8653. Introduced by Mr. Cooper (Rep., Ohio). Referred to the Committee on Labor. This bill divests goods manufactured or mined by convicts of their interstate character, and subjects them to the laws of the states into which they may be introduced.

IMPORTANT BILLS REVIEWED IN THIS ISSUE

MINING—

H. R. 9000: Ragon (D.), Ark. Mine Rescue Station.
H. R. 7752: Leavitt (R.), Mont. Mine Leases.
H. R. 7846: Colton (R.), Utah. Grazing Districts.
S. 3078: Smoot (R.), Utah. Land Grants.
H. R. 8310: Stephens (R.), Ohio. Mine Drainage.
S. 2709: Harreld (R.), Okla. Oil Leases.
H. R. 9181: Colton (R.), Utah. Oil Prospecting Permits.
H. R. 9133: Hayden (D.), Ariz. Oil and Gas Leases.

TARIFF—

H. R. 8641: James (R.), Mich. Copper Duty.
H. Res. 116: Hull (D.), Tenn. Iron and Steel.

COAL—

S. Res. 134: Copeland (D.), N. Y. Strike Intervention.
S. J. Res. 42: Copeland (D.), N. Y. Mine Control.
S. 3029: Robinson (D.), Ark. Strike Mediation.
H. R. 9222: Treadway (R.), Mass. Coal Economics Bureau.
H. R. 7371: Sinnott (R.), Oreg. Coal Trespass.

POWER DEVELOPMENT—

H. Con. Res. 4: Snell (R.), N. Y. Muscle Shoals Lease.
H. R. 6358: Newton (R.), Minn. Water Resources.
S. 1868: Johnson (R.), Calif. Colorado River.
S. J. Res. 40: Oddie (R.), Nev. State Water Rights.

LABOR—

H. R. 3811: Blanton (D.), Tex. Strike Prevention.
H. R. 3920: Moore (D.), Ky. Court Injunctions.
H. R. 9036: Vincent (R.), Mich. Immigrant Labor.

INDUSTRY—

H. R. 3895: McSwain (D.), S. C. Resource Conscription.
H. J. Res. 49: Garber (R.), Okla. Price Control.
H. R. 340: Johnson (R.), Wash. Federal Trade Commission.
S. Res. 109: Walsh (D.), Mont. Aluminum Company of America.

TRANSPORTATION—

H. R. 9463: Parker (R.), N. Y. Railroad Labor Disputes.
S. 575: Gooding (R.), Idaho. Freight Rates.

H. R. 9213. Introduced by Mr. Huddleston (Dem., Ala.). Referred to the Committee on Interstate Commerce. This bill would forbid the sale or shipment in interstate or foreign commerce of products of child labor or prison labor which are not branded to indicate such method of production.

Alaskan Railroad

H. R. 9391. Introduced by Mr. Perlman (Rep., N. Y.), by request. Referred to the Committee on Territories. This bill calls for surveys to extend the Alaskan Railroad from Fairbanks to the Yukon River; through Chandalar Pass to the Arctic; through Tanana Valley to Chisana Valley, and around Scolai Pass to McCarthys. It appropriates $100,000.

H. R. 6573. Reported by the Committee on Territories. This bill extends the time in which the Alaska Anthracite Railroad shall extend its lines in Alaska.

Mineral Entry

H. R. 9037. Introduced by Mr. Sinnott (Rep., Oreg.), by request of the Interior Department. Referred to the Committee on Public Lands. This bill validates certain land entries, including the mineral entry in Oregon of John H. Haggett.

Oil Field

H. J. Res. 119. Introduced by Mr. Sutherland (Rep., Alaska). Referred to the Committee on Rivers and Harbors. This resolution proposes a survey looking to construction of a harbor at Portage Bay, Alaska, to reach the Cold Bay oil fields.

Mineral Lands

S. 2740. Introduced by Mr. McNary (Rep., Oreg.). Referred to the Committee on Public Lands. This bill proposes to validate title to lands held under color of title for 20 years, but reserving the mineral content, on which prospecting and mining may be had under permits and leases from the Government.

S. 3078. Introduced by Mr. Smoot (Rep., Utah). Referred to the Committee on Public Lands. This bill proposes to quiet title to the states in lands on which suits as to their mineral content have not been instituted six years after the grant.

H. R. 9182. Introduced by Mr. Colton (Rep., Utah). Referred to the Committee on Public Lands. This is similar to the foregoing.

H. R. 7910. Introduced by Mr. Colton (Rep., Utah). Referred to the Committee on Public Lands. This bill grants title to school lands granted the states if suits as to their mineral character have not been filed within 6 years after the grant.

S. 2585. Introduced by Mr. Smoot (Rep., Utah). Referred to the Committee on Public Lands. This is similar to the foregoing.

H. J. Res. 171. Introduced by Mr. French (Rep., Idaho). Referred to the Committee on Public Lands. This bill authorizes a grant of lands to Idaho to replace school land grants which have been retaken by the Government because of their mineral content.

Mine Drainage

H. R. 8310. Introduced by Mr. Stephens (Rep., Ohio). Referred to the Committee on Rivers and Harbors. This bill regulates pollution of streams by oil and mine drainage as follows:

"That, within limits to be prescribed by the Secretary of War, it shall not be lawful to throw, discharge or deposit from any source whatever, any free acid or acid waste in any form, or any material which will become acid after being in the water, either directly or indirectly, into any navigable water of the United States, or into any tributary of any navigable water.

"In case the Chief of Engineers is satisfied after investigation that the discharge from any active or abandoned mine or from any factory or other establishment is acid or carrys materials which will become acid he may, if he regards it as necessary, prohibit the discharge of such waste or other material, or may regulate the entrance thereof into the stream, or may require the treatment of such discharge in such manner as to destroy its acidity.

"The Chief of Engineers shall consult and advise with the owner of any coal mine, either active or abandoned, or of any factory or other establishment, at the request of such owner or of his own motion, as to the best practicable and reasonably available means of rendering the waste or refuse therefrom harmless."

H. R. 3786. Introduced by Mr. Appleby (Rep., N. J.). Referred to the Committee on Rivers and Harbors. This bill makes it unlawful to deposit noxious acids in navigable waters. The bill forbids the discharge into such waters of oil or refuse matter of any kind. The War Department may permit the deposit of such material if it will not injure anchorage or navigation.

Oil Leases

S. 2709. Introduced by Mr. Harreld (Rep., Okla.) by request. Referred to the Committee on Indian Affairs. This bill provides that the Interior Department may reduce the area to be offered for oil lease on the Osage Indian Reservation in Oklahoma or suspend the offer of leases for not exceeding two years at any one time when an overproduction of oil, or inadequate prices therefor, make such extension or suspension desirable.

H. R. 8185. Passed by the House. This bill provides for 10-year mining leases on lands of the Crow Indians in Montant, subject to approval of the tribal council, those receiving leases to be diligent in their operations.

H. R. 9181. Introduced by Mr. Colton (Rep., Utah). Referred to the Committee on Public Lands. This bill extends for two years oil or gas prospecting permits where the holders have been unable to begin drilling operations or to drill to the depth and within the time required by existing law.

S. 2461. Introduced by Mr. Cameron (Rep., Ariz.). Reported by the Committee on Public Lands and passed by the Senate. This is similar to the foregoing.

H. R. 9133. Introduced by Mr. Hayden (Dem., Ariz.). Referred to the Committee on Indian Affairs. This bill authorizes oil and gas mining leases on unallotted lands in executive order Indian Reservations.

S. 3159. Introduced by Mr. Bratton (Dem., N. Mex.). Referred to the Committee on Indian Affairs. This is similar to the foregoing.

H. R. 8823. Introduced by Mr. Frear (Rep., Wis.). Referred to the Committee on Indian Affairs. This measure authorizes ten-year mining leases on unallotted lands of Indians held in trust by the Government.

S. 3158. Introduced by Mr. Wheeler (Dem., Mont.). Referred to the Committee on Indian Affairs. This is similar to the foregoing.

Mexican Oil

S. Res. 116. Introduced by Mr. La-Follette (Rep., Wis.). Passed by the Senate. This resolution called on the State Department for information as to the enactment of legislation by Mexico restricting mining rights in that country.

Mineral Publications

H. R. 8717. Introduced by Mr. Abernethy (Dem., N. C.). Referred to the Committee on Postoffices. This bill proposes to give second class mail privileges to bulletins and periodical publications issued by state boards and departments having jurisdiction over or engaged in promoting the conservation and development of natural resources.

Coinage Measures

H. R. 8267. Introduced by Mr. Thayer (Rep., Mass.). Referred to the Committee on Coinage. This bill proposes to coin a million 1-cent pieces as a memorial to Henry Wadsworth Longfellow.

H. R. 8306. Introduced by Mr. Miller (Rep., Wash.). Referred to the Committee on Coinage. This bill proposed to coin six million 50-cent pieces in memory of the pioneers of the Oregon Trail.

Revenue Measures

H. R. 1. Passed by the House and Senate. This is the tax revision bill.

H. R. 8641. Introduced by Mr. James (Rep., Mich.). Referred to the Committee on Ways and Means. This bill seeks to place an import duty of 6 cents per pound on copper.

H. Res. 116. Introduced by Mr. Hull (Dem., Tenn.). Referred to the Committee on Ways and Means. This resolution asks the committee to hold hearings and report a bill repealing duties in schedule 3 of the tariff act, known as the iron and steel or metal schedule, which the resolution says "are useless from the standpoint of revenue and appreciable competition," and to reduce to a moderate or competitive basis for revenue "such duties as are either excessive or prohibitive."

The resolution also proposes reduction of the duty on electrical machinery and apparatus; limestone; magnesite; hoop or band iron for baling cotton; the 8 percent countervailing duty on coal, and for repeal of the flexible provision.

S. Res. 147. Introduced by Mr. Shipstead (F. L., Minn.). This resolution calls for an investigation by a committee of five Senators of the activities of the Tariff Commission under the flexible provision of the tariff law.

Coal

S. Res. 134. Introduced by Mr. Copeland (Dem., N. Y.). Passed by the Senate. This resolution requested the President to invite to the White House, at such time as he thinks best, the committee of operators and miners, in order that he might urge upon them the national importance of settlement of the anthracite strike. The President did not comply with the resolution and a few days after its passage the strike was settled at a conference between the operators and miners, largely through the efforts of Richard F. Grant of the M. A. Hanna Co., of Cleveland.

S. J. Res. 42. Introduced by Mr. Copeland (Dem., N. Y.). Referred to the Committee on Interstate Commerce. This resolution sought to authorize the President during the anthracite strike to supervise or take control of any anthracite mine.

S. J. Res. 43. Introduced by Mr. Copeland (Dem., N. Y.). This resolution proposed to authorize the President to appoint a Federal Fuel Distributor, by reviving the emergency fuel control law of September 22, 1922, which had since expired.

S. Res. 137. Introduced by Mr. Capper (Rep., Kans.). Passed by the Senate. The resolution authorized the Senate Committee on District of Columbia to investigate retail coal prices in the District and to examine books of dealers to determine if they charge unduly high prices.

S. Res. 132. Introduced by Mr. Howell (Rep., Nebr.). This bill requested the Senate District Committee to bring in a bill permitting the Government fuel yard in the District to sell coal to citizens of the District for cost at cash, during seasons of high coal prices in order to terminate excessive charges for fuel in the District.

H. R. 8599. Introduced by Mr. Treadway (Rep., Mass.). Referred to the Committee on District of Columbia. This bill proposed to regulate coal dealers in the District through a license system administered by a bureau of fuel administration under the Commissioners of the District. This bureau would have authority to reduce prices charged by dealers if they represented too wide a spread between cost and selling prices.

H. J. Res. 116. Introduced by Mr. Berger (Soc., Wis.). Referred to the Committee on Interstate Commerce. This resolution proposed to authorize the President to take over and operate the anthracite mines permanently.

Strike Mediation

S. 3029. Introduced by Mr. Robinson (Dem., Ark.). Referred to the Committee on Labor. This bill proposes to create a board of industrial adjustments to settle coal mine strikes. This bill, which is being considered by a subcommittee, provides as follows:

"That whenever, in the opinion of the President or of the Congress, an emergency exists in which the public health or safety is endangered respecting the production or the distribution of anthracite or bituminous coal, or both, the President shall forthwith issue his proclamation declaring the existence of such emergency, and convening in immediate session the Board of Industrial Adjustments, hereinafter authorized, which board shall forthwith proceed to

inquire into the causes of such emergency, to make findings respecting the same, and to make recommendations and take action for the termination thereof.

"That whenever the production or distribution of anthracite or bituminous coal, or both, has been suspended or interfered with because of strikes or lockouts, to the extent that trade or commerce in coal is seriously interfered with, and the public health or safety is endangered thereby, an emergency respecting the production or distribution of coal shall be deemed to exist.

"There is hereby created a Board of Industrial Adjustments, to consist of the Secretary of Labor, the Secretary of Commerce, and the Chief of the Bureau of Mines, and two citizens of the United States who are not engaged or financially interested in the production or distribution of coal, to be appointed by the President. The board shall be convened by proclamation of the President whenever, in his opinion or whenever in the opinion of Congress expressed by concurrent resolution, an emergency, as hereinbefore described, exists. Such board is empowered to conciliate differences, encourage arbitration, and to inquire into the causes of such emergency, to find facts in relation thereto, and to recommend processes and methods whereby the causes of said emergency may be removed or terminated.

"The said board may inquire into and report its findings respecting the practices and transactions of dealers in coal, and suggest methods to protect the consumers of coal from extortion and oppression during the continuance of said emergency. The President, whenever in his opinion the circumstances and conditions justify, by proclamation may declare that the emergency has terminated, after which the Board of Industrial Adjustments shall take no further action than to publish such of its proceedings as it may deem necessary in the public interest.

"The Board of Industrial Adjustments is authorized to hold hearings, subpoena and examine witnesses, employ experts and other agents, compel the production of books and papers, and publish its proceedings in whole or in part as and when it may deem necessary."

The bill appropriates $100,000.

Similar bills were introduced in the House by the following members and referred to the Committee on Interstate Commerce:

H. R. 9102 by Mr. Oliver (Dem., N. Y.); H. R. 9100 by Mr. Black (Dem., N. Y.); H. R. 9111 by Mr. Bloom (Dem., N. Y.); H. R. 9112 by Mr. Boylan (Dem., N. Y.); H. R. 9113 by Mr. Carew (Dem., N. Y.); H. R. 9114 by Mr. Cellar (Dem., N. Y.); H. R. 9115 by Mr. Cleary (Dem., N. Y.); H. R. 9116 by Mr. Cullen (Dem., N. Y.); H. R. 9117 by Mr. Douglass (Dem., Mass.); H. R. 9118 by Mr. Dickstein (Dem., N. Y.); H. R. 9119 by Mr. Griffin (Dem., N. Y.); H. R. 9120 by Mr. Auf Der Heide (Dem., N. J.); H. R. 9121 by Mr. Kindred (Dem., N. Y.); H. R. 9122 by Mr. Lindsay (Dem., N. Y.); H. R. 9123 by Mr. Mead (Dem., N. Y.); H. R. 9124 by Mrs. Norton (Dem., N. J.); H. R. 9125 by Mr. O'Connell (Dem., N. Y.); H. R. 9126 by Mr. O'Connor (Dem., N. Y.); H. R. 9127 by Mr. Prall (Dem., N. Y.); H. R. 9128 by Mr. Quayle (Dem., N. Y.); H. R. 9129 by Mr. Somers (Dem., N. Y.); H. R. 9130 by Mr. Sullivan (Dem., N. Y.); H. R. 9131 by Mr. Weller (Dem., N. Y.); H. R. 9170 by Mr. Gallivan (Dem., Mass.).

H. Res. 127. Introduced by Mr. Watres (Rep., Pa.). Referred to the Committee on Interstate Commerce. This resolution requested the Secretary of Labor to meet the anthracite operators and miners in an effort to settle the strike.

Coal Bureau

H. R. 9222. Introduced by Mr. Treadway (Rep., Mass.). Referred to the Committee on Interstate Commerce. This bill proposes to create a Bureau of Coal Economics in the Department of Commerce to regulate the coal industry. It is similar to the bill previously introduced by Senator Oddie (Rep., Nev.), and creates an Undersecretary of Commerce in charge of mines and mining. The bureau would call on those in the coal industry for reports regarding costs, etc., and would conduct various investigations looking to stabilization of the industry. Provision is made for advisory committees representing the anthracite and bituminous industries to assist in the investigations. Regulation of the quality of coal is also proposed. The bureau would also assist in promoting harmonious relations between operators and miners, and in case of disputes would investigate and report to the President as to terms of settlement. Provision is also made to revive the fuel control law of 1922 under which a Federal fuel distributor would be appointed and the Interstate Commerce Commission would expedite the movement of coal.

H. R. 9223. Introduced by Mr. Fish (Rep., N. Y.). Referred to the Committee on Interstate Commerce. This is similar to the foregoing.

H. J. Res. 165. Introduced by Mr. Kelly (Rep., Pa.). Referred to the Committee on Interstate Commerce. This resolution proposed to establish an anthracite coal commission of five members, to be appointed by the President, to adjust the anthracite strike.

H. R. 9134. Introduced by Mr. LaGuaria (Soc., N. Y.). Referred to the Committee on Interstate Commerce. This bill proposed to appropriate $75,000,000 to enable the President to purchase and sell anthracite at cost through the Department of Commerce during the anthracite strike.

S. Res. 112. Introduced by Mr. King (Dem., Utah). Referred to the Committee on the Judiciary. This resolution proposes to direct that committee to investigate alleged monopolies in coal, copper, steel, and other commodities.

Coal Trespass

H. R. 7371. Introduced by Mr. Sinnott (Rep., Oreg.) by request of the Interior Department. Reported by the Committee on Public Lands and passed by the House. This bill provides as follows:

"That it shall be unlawful to mine and remove coal of any character, whether anthracite, bituminous, or lignite, from beds or deposits in lands of the United States, or in deposits or beds reserved to the United States, with the intent wrongfully to appropriate, sell, or dispose of the same, and every person who shall violate any of the provisions of this act shall be deemed guilty of misdemeanor and fined not more than $1,000 or imprisoned not more than one year, or both.

"Nothing in this act, however, shall interfere with any right or privilege conferred by existing laws of the United States."

H. R. 9309. Introduced by Mr. Woodruff (Rep., Mich.). Referred to the Committee on Naval Affairs. This bill proposes to sell various naval properties, including the coal depot at Frenchmans Bay, Me.

H. R. 6533. Introduced by Mr. Woodruff (Rep., Mich.). Referred to the Committee on Naval Affairs. This is similar to the foregoing.

Power Development

H. Con. Res. 4. Introduced by Mr. Snell (Rep., N. Y.). Passed by the House and reported by the Senate Agricultural Committee. This resolution provides for a committee of three members of the Senate Agricultural Committee and three members of the House Military Committee to conduct negotiations for lease of the nitrate and power properties at Muscle Shoals, Ala., for production of nitrates primarily and for power purposes incidentally, the lease to be not more than 50 years.

H. Con. Res. 2. Introduced by Mr. Snell (Rep., N. Y.). Referred to the Committee on Rules. This was similar to the foregoing.

H. J. Res. 59. Introduced by Mr. Madden (Rep., Ill.). Referred to the Committee on Rules. This was similar to the foregoing.

S. 2147. Introduced by Mr. Norris (Rep., Nebr.). Referred to the Committee on Agriculture. This bill provides for operation of Dam No. 2 at Muscle

Shoals and for construction of other dams on the Tennessee River by a Federal Power Corporation. Morris L. Cook of Pennsylvania, James D. Ross of Washington, and John R. Neal of Tennessee, are named as directors.

S. J. Res. 35. Introduced by Mr. Norris (Rep. Nebr.). Referred to the Committee on Agriculture. This resolution suspends the authority of the Federal Power Commission to issue licenses on the Tennessee River until Congress takes final action for control, operation, or disposition of Dam No. 2, at Muscle Shoals, Ala. This has been adversely reported on by the Federal Power Commission.

S. 3081. Introduced by Mr. McKellar (Dem., Tenn.). Referred to the Committee on Agriculture. This bill proposes distribution of surplus power to consumers by a Muscle Shoals commission.

S. 3123. Introduced by Mr. Ransdell (Dem., La.). Referred to the Committee on Agriculture. This bill gives the Federal Power Commission control over the Muscle Shoals project.

S. 2956. Introduced by Mr. Smith (Dem., S. C.). Referred to the Committee on Agriculture. This bill creates a Government commission to operate the Muscle Shoals property.

An amendment was introduced by Senator Ransdell (Dem., La.) to H. Con. Res. 4 to provide for disposition of surplus power from the Muscle Shoals plant under the Federal water power act.

H. R. 8582. Introduced by Mr. Moore (Dem., Va.). Referred to the Committee on the District of Columbia. This bill proposes to develop water power at the Great Falls of the Potomac River under license of the Federal Power Commission.

H. R. 6781. Introduced by Mr. Browne (Rep., Wis.). Referred to the Committee on Indian Affairs. This bill appropriates $6,000 for investigations to determine the possibility of developing hydroelectric power on rivers in the Menominee Reservation in Wisconsin.

H. R. 8303. Introduced by Mr. Browne (Rep., Wis.). Referred to Committee on Indian Affairs. This bill proposes power development at Keshena Falls on the Wolf River, on the Menominee Indian Reservation, Wis.

H. R. 8959. Introduced by Mr. Oldfield (Dem., Ark.). Referred to the Committee on Rivers and Harbors. This bill proposes an investigation to determine the possibility of developing electric and water power on the Cache River in Arkansas.

S. 663. Introduced by Mr. King (Dem., Utah). Referred to the Committee on Irrigation. It proposes an investigation by the Reclamation Service of possible dam and reservoir sites on Green River, Utah, for power and irrigation. It appropriates $20,000.

S. 1856. Passed by the Senate. This bill authorizes the lease for not more than 50 years of surplus power developed in connection with irrigation projects.

Water Resources

H. R. 6358. Introduced by Mr. Newton (Rep., Minn.). Referred to the Committee on Interstate Commerce. This bill appropriates $400,000 for this year and $500,000 for each of the next 19 years for an inventory by the Geological Survey of the water resources of the country to develop a plan for use of surface and ground waters for industrial, power, and other purposes.

H. R. 9397. Introduced by Mr. Newton (Rep., Minn.). Referred to the Committee on Interstate Commerce. This is similar to the foregoing.

S. 1868. Introduced by Mr. Johnson (Rep., Calif.). Referred to the Committee on Irrigation. This bill provides for development of the lower Colorado River Basin for electrical power and other purposes. It provides for the construction of a dam at Black or Boulder Canyon at a cost of $70,000,000.

H. R. 6251. Introduced by Mr. Swing (Rep., Calif.). Referred to the Committee on Irrigation. This is similar to the foregoing.

S. 664. Introduced by Mr. King (Dem., Utah). Referred to the Irrigation Committee. This measure authorizes the President to determine the best means for utilizing the water resources of the Colorado River Basin through a commission of three members, two of whom shall be engineer and one with knowledge of hydraulics and of financing enterprises, for use of the water for irrigation and power. It appropriates $100,000.

H. R. 5025. Introduced by Mr. O'Connor (Dem., La.). Referred to the Committee on Flood Control. This bill creates a waterways and water resources commission, consisting of the Secretaries of War, Interior, and Agriculture, and one member of the Senate and one of the House. This commission would study the development or control of waterways, including utilization of water power. The bill appropriates $500,000.

S. J. Res. 40. Introduced by Mr. Oddie (Rep., Nev.). Referred to the Committee on Irrigation. This bill proposes to give to the states the right to unappropriated waters in their boundaries.

H. R. 7716. Introduced by Mr. Ragon (Dem., Ark.). Referred to the Committee on Flood Control. This bill provides for a survey of the Arkansas River and rivers and lands east of the Rocky Mountains and southwest of the Arkansas River to its conjunction with the Mississippi to ascertain their possibilities for power and other development.

S. J. Res. 4. Introduced by Mr. Pittman (Dem., Nev.). Passed by the Senate. This resolution suspended until February, 1928, the authority of the Federal Power Commission to issue licenses for power development on the Colorado River, in order to allow uniform development by agreement between the states affected.

Waterway Improvements

S. 1054. Introduced by Mr. Brookhart (Rep., Iowa). Referred to the Committee on Commerce. This bill appropriates $8,000,000 for inland river improvements. It provides for an inland waterways corporation of six members to develop Government-owned inland and coastwise waterways.

H. J. Res. 158. Introduced by Mr. Mooney (Dem., Ohio). Referred to the Committee on Rivers and Harbors. This bill proposes a survey to secure a 24-foot depth in the Great Lakes from Duluth and Chicago to Buffalo.

H. R. 6471. Introduced by Mr. Reed (Rep., N. Y.). Referred to the Committee on the Judiciary. This bill proposes to incorporate the Lakes-Hudson Ship Canal Co. to provide a waterway from tidewater in the Hudson River through New York state to the Great Lakes. Millard F. Bowen, of Buffalo, leader in this project and others, are named as incorporators. The corporation would also be authorized to develop electric water power along the route.

H. R. 8372. Introduced by Mr. Ellis (Rep., Mo.). Referred to the Committee on Rivers and Harbors. This bill appropriates $20,000,000 for connecting channels from Chicago to New Orleans and from Pittsburgh to Kansas City.

H. R. 8542. Introduced by Mr. Sosnowski (Rep., Mich.). Referred to the Committee on Rivers and Harbors. This bill appropriates $60,000,000 for 25-foot channels and harbors on the Great Lakes.

H. R. 8976. Introduced by Mr. Sosnowski (Rep., Mich.). Referred to the Committee on Rivers and Harbors. This is similar to the foregoing.

H. R. 8510. Introduced by Mr. Chalmers (Rep., Ohio). Referred to the Committee on Rivers and Harbors. This bill proposes a 25-foot channel in the Great Lakes and principal harbors thereon.

H. R. 8742. Introduced by Mr. Green (Dem., Fla.). Referred to the Committee on Rivers and Harbors. This bill authorizes a survey for a barge canal from Cumberland Sound to the mouth of the Mississippi River.

S. 3899. Introduced by Mr. Mapes (Rep., Mich.). Referred to the Committee on Interstate Commerce. This bill proposes to authorize a deep waterway for ocean vessels from the Great Lakes to the Atlantic Ocean via the St. Lawrence River and Welland Canal. It appropriates $100,000 for the American

members of the International Board of Engineers to work out the plans.

H. R. 8392. Introduced by Mr. Freeman (Rep., Conn.). Referred to the Committee on Rivers and Harbors. This bill proposes to appropriate $11,500,000 for the purchase of the Cape Cod Canal.

H. R. 37. Introduced by Mr. Briggs (Dem., Tex.). Referred to the Committee on Ways and Means. This bill proposes to establish foreign trade zones in ports of entry of the United States to expedite foreign commerce. These zones would have adequate facilities for coal or other fuel.

CHEMICALS

H. R. 7893. Passed by the House. This bill creates a cooperative marketing division in the Department of Agriculture to cover agricultural products, naval stores, and products of forests.

H. R. 9213. Introduced by Mr. Wilson (Dem., La.). Referred to Committee on Appropriations. This bill appropriates $250,000 for experimental construction of airplanes for spreading arsenicals against the cotton boll weevil.

Senator Ransdell (Dem., La.) introduced an amendment to the agricultural appropriation bill making a similar appropriation.

H. R. 8456. Introduced by Mr. Byrns (Dem., Tenn.) by request. Referred to the Committee on Interstate Commerce. This bill amends the law regarding adulterated or misbranded lead arsenates and insecticides.

H. R. 8305. Introduced by Mr. Griest (Rep., Pa.). Referred to the Committee on Interstate Commerce. This bill proposes to safeguard the distribution of dangerous caustic or corrosive acids and alkalies.

S. 2320. Introduced by Mr. Pepper (Rep., Pa.). Referred to the Committee on Interstate Commerce. This is similar to the foregoing.

S. Res. 130. Introduced by Mr. Brookhart (Rep., Iowa). Referred to the Committee on Agriculture. It proposes an investigation by that committee of charges that the forests products laboratory at Madison, Wis., is acting with creosote interests to destroy the sale of products of the Arthur Arent Laboratories of Des Moines.

S. Res. 131. Introduced by Mr. Brookhart (Rep., Iowa). Referred to the Committee on Expenditures. It proposes an investigation by the Agricultural Committee to compare the success of farming interests and business interests organized into trade associations and the comparative selling prices of products, incomes and profits of agriculture and of business.

LABOR

H. R. 3811. Introduced by Mr. Blanton (Dem., Tex.). Referred to the Committee on Interstate Commerce. This bill makes it unlawful for two or more persons to combine or agree to prevent, hinder, or restrain any other person from seeking and engaging in work for railroads or boats carrying the mails or engaged in interstate traffic. The bill, however, would not deny any employe the right to quit work at his option.

H. R. 3920. Introduced by Mr. Moore (Dem., Ky.). Referred to the Committee on the Judiciary. This bill provides that contracts, combinations, or agreements between two or more persons to do any act in a trade or labor dispute shall not be considered criminal, and that such person shall not be subject to restraining orders or injunctions.

S. Res. 88. Introduced by Mr. Wheeler (Dem., Mont.). Referred to the Committee on Labor. This resolution proposes an investigation by that committee of the system of industrial espionage and to report legislation to correct such practices. The resolution says private detective agencies are obtaining money from business concerns and organizations by falsely representing movements among employes by joining labor organizations and advocating revolutionary methods for discrediting labor organizations and by manufacturing scares concerning radical propaganda. These agencies are said to be detrimental to peaceful relationship between employers and employes.

S. 981. Introduced by Mr. Copeland (Dem., N. Y.). Referred to the Committee on Labor. This bill appropriates $100,000 for investigations by a commission of unemployment of the needs of the country for public work to be conducted by Federal, state, and municipal agencies to provide employment in periods of business depression.

S. 972. Introduced by Mr. Shipstead (F.L., Minn.). Referred to the Committee on the Judiciary. This bill would prevent courts from issuing restraining orders or injunctions against participants in labor disputes.

H. R. 9036. Introduced by Mr. Vincent (Rep., Mich.). Referred to the Committee on Immigration. This bill provides that skilled or agricultural labor may be imported if labor of like kind unemployed can not be found in this country. The necessity of importing such labor would be determined by the Secretary of Labor on application of interested parties.

INDUSTRIAL CONSCRIPTION

H. R. 3895. Introduced by Mr. McSwain (Dem., S. C.). Referred to the Committee on Military Affairs. This bill provides that during war the President shall draft "all material resources of supplies, manufactories, transportation, finances, and all other property." The peace-time price shall be paid for such property thus taken over. To prevent profiteering the President shall fix the sale price of all commodities. The bill establishes "courts of compensation," which shall pass on appeals from compensation paid for commandeered property or from prices fixed by the Government. Persons who furnish the Government defective supplies or who attemp to collect a larger sum than due on supplies shall be fined not more than $1,000,000, or imprisoned 20 years, or both. Similar punishment would be imposed for violation of any other provision of the act.

H. R. 4800. Introduced by Mr. Johnson (Rep., S. Dak.). Referred to the Committee on Military Affairs. This bill provides for Government control of material resources and industrial organizations and stabilization of prices during war.

H. J. Res. 24. Introduced by Mr. LaGuardia (Soc., N. Y.). Referred to the Committee on Foreign Affairs. This resolution requests the President to call a conference of nations in Washington to outlaw war and to "punish war profiteers."

H. J. Res. 11. Introduced by Mr. Evans (Dem., Mont.). Referred to the Judiciary Committee. This resolution proposes a constitutional amendment to conscript persons and property during war.

H. J. Res. 34. Introduced by Mr. Ramseyer (Rep., Iowa). Referred to the Committee on Rules. This resolution creates a commission of five Senators and five Representatives to investigate and report in December on plans for drafting human and material resources and forbidding profits by individua!s, corporations, and combinations during war.

H. J. Res. 49. Introduced by Mr. Garber (Rep., Okla.). Referred to the Committee on the Judiciary. The bill proposes a constitutional amendment giving Congress power during war to conscript industries and properties and to stabilize prices of commodities.

H. R. 287. Introduced by Mr. French (Rep., Idaho). Referred to the Committee on Military Affairs. This bill proposes to draft material resources and organizations and to stabilize prices during war.

H. R. 46. Introduced by Mr. Hill (Rep., Md.). Referred to the Committee on Military Affairs. This bill reorganizes the War and Navy Departments into a Department of Defense. It provides for an Undersecretary for National Resources, who would supervise munitions and fuel matters. Waterways, engineering activities, the California Debris Commission which regulates hydraulic mining, and the Alaskan Road Commission would be transferred from the War Department to the Interior Department.

TRADE AND COMMERCE

H. R. 340. Introduced by Mr. Johnson (Rep., Wash.). Referred to the Committee on Interstate Commerce. This bill proposes to abolish the Federal Trade Commission. It provides that the Secretary of Commerce shall recommend to Congress functions to be exercised by that department in protecting those engaged in interstate commerce.

S. 672. Introduced by Mr. King (Dem., Utah). Referred to the Committee on Interstate Commerce. This bill proposes to abolish the Federal Trade Commission after July 1 and to turn over to the Department of Justice its records and cases, which would be completed by the Attorney General.

S. 2146. Introduced by Mr. Wadsworth (Rep., N. Y.). Referred to the Committee on Interstate Commerce. This bill amends section 5 of the Federal Trade Commission act, changing the procedure of the commission in respect to consideration of cases involving unfair methods of competition.

H. R. 6110. Introduced by Mr. Williams (Rep., Ill.). Referred to the Committee on Interstate Commerce. This is similar to the foregoing.

ALUMINUM COMPANY

S. Res. 109. Introduced by Mr. Walsh (Dem., Mont.). Adopted by the Senate. This resolution directed the Senate Judiciary Committee to inquire whether the Department of Justice had diligently prosecuted an inquiry as to violation by the Aluminum Co. of America of a court decree forbidding discriminatory practices against competitors in order to suppress competition. The committee recommends further investigation of the matter.

S. Res. 110. Introduced by Mr. Walsh (Dem., Mont.). Passed by the Senate. This resolution requested the Attorney General to report whether refusal of the Federal Trade Commission to allow the Department of Justice to inspect its records in the Aluminum Co. case was justified. The Attorney General reported that it was.

S. Res. 141. Passed by the Senate. This resolution directed the Federal Trade Commission to send to the Senate evidence in its case against the Aluminum Co. of America. The commission supplied the data.

H. Res. 134. Introduced by Mr. Schafer (Rep., Wis.). Referred to the Committee on Rules. This resolution proposes an investigation by the Committee on Expenditures in the War Department of the administration of the Alien Property Custodian, including its sale of patents to the Chemical Foundation and release of property to the American Metal Co.

H. R. 8944. Introduced by Mr. Mills (Rep., N. Y.). Referred to the Committee on Interstate Commerce. This bill proposes detailed provisions governing sales and contracts in interstate and foreign commerce.

S. 2792. Introduced by Mr. Ernst (Rep., Ky.). Referred to the Judciary Committee. This is similar to the foregoing.

H. R. 8769. Introduced by Mr. Holaday (Rep., Ill.). Referred to Committee on Ways and Means. This bill proposes a bond issue of $3,000,000,000 to finance a five-year program of road construction.

H. R. 9275. Introduced by Mr. Shallenberger (Dem., Nebr.). Referred to the Committee on Interstate Commerce. This bill proposes a Government monopoly of the telephone, telegraph and radio system under the Post Office Department. It provides for a $250,000,000 bond issue to purchase the private systems.

H. J. Res. 101. Introduced by Mr. Andrew (Rep., Mass.). Referred to the Committee on Ways and Means. This bill proposes to extend to France as favorable terms for settlement of its debt as have been or may be granted to other countries. It says the loans were used to purchase iron, steel, copper, chemicals, powder, etc., in the United States in winning the war.

H. R. 8497. Introduced by Mr. Butler (Rep., Pa.). Referred to the Committee on Naval Affairs. This bill proposes to authorize $300,000 for the construction of an experimental metal-clad airship.

H. R. 9453. Introduced by Mr. Butler (Rep., Pa.). Referred to the Committee on Naval Affairs. This is similar to the foregoing.

TRANSPORTATION

H. R. 9463. Introduced by Mr. Parker (Rep., N. Y.). Reported by the Committee on Interstate Commerce. This bill is a new draft of a former measure presented by Mr. Parker, which provides for abolition of the Railroad Labor Board and for appointment of regional and other boards to settle railroad labor disputes. It appropriates $300,000.

S. 3170. Introduced by Mr. Cummins (Rep., Iowa). Referred to the Committee on the Judiciary. This bill proposes compensation for maritime employes and their dependents for injuries or death, to be administered by the United States Employes Compensation Commission.

S. 575. Introduced by Mr. Gooding (Rep., Idaho). Reported by the Committee on Interstate Commerce. This bill is known as the long and short haul bill and would forbid railroads from charging more for a short haul than for a long haul.

S. 2934. Introduced by Mr. Butler (Rep., Mass.). Referred to the Committee on Interstate Commerce. This bill proposes to prohibit port differentials and other rate handicaps.

S. 2808. Introduced by Mr. Smith (Dem., S. C.). Referred to the Committee on Interstate Commerce. This bill proposes that two members each of 12 members of the Interstate Commerce Commission shall be appointed from each of the following groups: New England, Middle Atlantic, Lake, South Atlantic, Gulf, and Mountain.

S. 3120. Introduced by Mr. Trammell (Dem., Fla.). Referred to the Committee on Interstate Commerce. This is similar to the foregoing.

H. R. 8045. Introduced by Mr. Morrow (Dem., N. Mex.). Referred to Committee on Interstate Commerce. This bill would require railroads to secure permission from the Interstate Commerce Commission to abandon any of their lines.

S. 671. Introduced by Mr. King (Dem., Utah). Referred to the Committee on Interstate Commerce. This bill declares illegal agreements, contracts, combinations, incorporations, trusts, associations, arrangements, meetings, conferences, or understandings to control trade in any commodity or to fix or determine the sale price of commodities or to restrict or withhold commodities from sale or transportation for the purpose of excluding any person from buying, selling, or producing such commodities.

S. 2930. Introduced by Mr. King (Dem., Utah). Referred to the Committee on Judiciary. This bill supplements the antitrust law by making illegal every contract, combination, cooperative arrangement, protective association, trust, organized effort, or conspiracy, which does not sustain the normal form of competition in trade or commerce, which operates to restrict competition, or whose purpose is to collect and use trade information tending to produce uniformity in price or limitation in production.

S. 1035. Introduced by Mr. Walsh (Dem., Mont.). Passed by the Senate. This bill would punish for contempt by a fine of $100,000 persons who refuse to testify in a Government suit who may be temporarily in a foreign country. This bill was prompted by the refusal of some witnesses to testify while abroad in the Government suit involving the naval oil reserve leases.

S. 1045. Introduced by Mr. Walsh (Dem., Mont.). Referred to the Committee on Judiciary. This bill proposes to prevent evasions of the antitrust laws. It provides that from one year after its approval the ownership or control, direct or indirect, by any person, partnership, association, or corporation of any stock or other property interest in more than one association or corporation in interstate commerce which has been a member of a combination dissolved by a court under the antitrust act or which has acquired control of any of the works, plants, or other operating property or

patents or brands of such a combination or any constituent element shall be prohibited. The act would be enforced by the Federal Trade Commission.

CLAIMS

H. R. 7732. Introduced by Mr. Underhill (Rep., Mass.). Passed by the House. This bill proposes to apply the wage increase of the National War Labor Board to those entering the employ of the Bethlehem Steel Co. after August 1, 1918, the same as those who were employed prior thereto. It also provides for administration of the relief act by the Secretary of War, and approval of the accounts by the General Accounting Office, to meet a recent decision of the Comptroller General. The act provided $1,600,000 for this purpose, and the War Department asked that $100,000 be allowed for its administration, be conducted at Bethlehem, Pa., in order to have access to the records of the company.

H. R. 5945. Introduced by Mr. Andresen (Rep., Minn.). Referred to the Committee on Claims. This bill proposes to pay $1,200,000 to carry out the award of the National War Labor Board of 1919, which increased the wages of employes of the Minneapolis Steel and Machinery Co. and others.

S. 1906. Introduced by Mr. Shipstead (F. L., Minn.). Referred to the Committee on Claims. Similar to the above.

H. R. 2812. Introduced by Mr. Bacharach (Rep., N. J.). Referred to the Committee on Claims. This bill would authorize the International Petroleum Co. of Toronto to sue the Government for damages to one of its chartered tank steamers by collision with a submarine in the Canal Zone in 1918.

S. 2144. Introduced by Mr. Sheppard (Dem., Tex.). Referred to the Committee on Claims. This bill provides for payment of $4,677 to the Tampico Marine Iron Works under a Shipping Board contract in 1920.

H. R. 2848. Introduced by Mr. Burton (Rep., Ohio). Referred to the Committee on Claims. This bill proposes to pay $3,052 to the Van Dorn Iron Works Co. on a postal contract.

H. R. 7424. Introduced by Mr. Taylor (Rep., Tenn.). Referred to the Committee on Claims. This bill proposes to pay $17,180 to the Guamoco Mining Co. of Greeneville, Tenn., for overpayment of the excess profits tax in 1917.

S. 181. Introduced by Mr. Smoot (Rep., Utah). Referred to the Committee on Claims. This bill proposes to refund $498 to the Utah Fuel Co., paid in 1920, as an admission tax to an entertainment given by the company, which was tax exempt.

H. R. 3429. Introduced by Mr. Madden (Rep., Ill.). Referred to the Committee on Claims. This bill proposes to pay $2,500 to the Interstate Iron and Steel Co., and $3,500 to the General Chemical Co. for reimbursement of contributions for improvement of the Calumet River in 1920.

H. R. 3141. Introduced by Mr. Hudspeth (Dem., Tex.). Referred to the Committee on Claims. This bill authorizes the payment of $1,622 to the Awbrey Coal and Coke Co. of El Paso, Tex., in connection with an error on a bid for coal for the Army.

H. R. 4650. Introduced by Mr. Morin (Rep., Pa.). Referred to the Committee on War Claims. This bill proposes to pay $56,278 to the Machinery and Metals Corporation of Philadelphia on account of an Army brass rod contract.

H. R. 4368. Introduced by Mr. Taylor (Dem., W. Va.). Referred to the Committee on Claims. This bill proposes to pay $2,000 to the Kanawha Valley Coal Co. of West Virginia, representing a fine against the company for violation of the fuel control act during the war, which, under a Supreme Court decision, was illegally assessed.

S. 2019. Introduced by Mr. Cameron (Rep., Ariz.). Referred to the Committee on Claims. This bill proposes to pay $334,582 to the Shannon Copper Co. for production of copper for war purposes under the President's Mediation Commission of 1917.

H. R. 5866. Introduced by Mr. Graham (Rep., Pa.). Referred to the Committee on the Judiciary. This bill authorizes the Lehigh Coal and Navigation Co. of Philadelphia to sue the Government in the District Court for the Eastern District of Pennsylvania for damage to one of its vessels by an Army tug in the Schuylkill River in 1920.

REVENUE ACT OF 1926

(*Continued from page* 178)

A joint Congressional committee on internal-revenue taxation is established to be composed of 10 members, five to be selected from the membership of the Ways and Means Committee of the House and five from the Finance Committee of the Senate. Provision is made for the employment of necessary experts and assistants through whom the joint committee will be in direct contact with taxpayers for the purpose of obtaining all necessary information, to assist in the framing of future revenue legislation. The duties prescribed for this body are as follows:

(1) To investigate the operation and effects of the Federal system of internal-revenue taxes.

(2) To investigate the administration of such taxes by the Bureau of Internal Revenue or any executive department, establishment, or agency, charged with their administration.

(3) To make such other investigations in respect of such system of taxes as the Joint Committee may deem necessary.

(4) To investigate measures and methods for the simplification of such taxes, particularly the income tax.

(5) To publish, from time to time, for public examination and analysis, proposed measures and methods for the simplification of such taxes, and to make to the Senate and the House of Representatives, not later than December 31, 1927, a definite report thereon, together with such recommendations as it may deem advisable.

(6) To report, from time to time, to the Committee on Finance and the Committee on Ways and Means and, in its discretion, to the Senate or the House of Representatives, or both, the results of its investigations, together with such recommendations as it may deem advisable.

Many claims for amortization were held up under a decision of the Board of Tax Appeals that such claims must have been filed with the original return for the year 1918 to get the deduction in 1918, and for 1919 to get the deduction in that year, etc. The new law relieves this situation by providing that "Sec. 1209. The deduction provided by paragraph (9) of subdivision (a) of section 214 or by paragraph (8) of subdivision (a) of section 234 of the Revenue Act of 1918 may (notwithstanding any provisions of the Revenue Act of 1921) be allowed for the taxable year 1918, 1919, or 1920 if claim therefor was made before June 15, 1924.

The new law provides that in the case of an individual citizen of the United States, a bona fide non-resident of the United States for more than six months during the taxable year, amounts received from sources without the United States if such amounts constitute earned income as defined in Section 209, shall be exempt from tax; but that such individual shall not be allowed as a deduction from his gross income any deductions properly allocable to or chargeable against amounts excluded from gross income under this provision.

The changes in the law relating to affiliated corporations, interest on over- or under-payments of taxes, procedure before the Board of Tax Appeals and the jurisdiction of that board under the new act, will be discussed in a later article. In many respects, the new law is an improvement over previous laws. It affords material relief to taxpayers. It clarifies many administrative matters. It provides for a proper investigation of the internal-revenue taxation system out of which constructive recommendations, which taxpayers have been given full opportunity to analyze, will be evolved.

ANNUAL MEETING AMERICAN INSTITUTE MINING ENGINEERS

Interesting And Well Attended Sessions Marked Annual Meeting Of American Institute Of Mining And Metallurgical Engineers—Samuel A. Taylor Elected To Presidency—Important Technical Problems Discussed

MEETING in New York from February 15 to 18, the annual session of the American Institute of Mining and Metallurgical Engineers considered a number of important problems concerning mining processes, heard interesting discussions of mining questions by leading mining engineers of the country, and selected Samuel Alfred Taylor, of Pittsburgh, as its new president. Mr. Taylor is an outstanding figure in the mining industry and has been conspicuously prominent in the coal branch. He was president of the American Mining Congress in 1913, and has held many other important positions in mining societies and in Government administrative activities. During the war he was an advisor to the fuel administrator, and for the Coal Commission he assisted in making a valuation of coal lands. The other officers elected by the institute were: Vice-presidents, B. O. Mahaffey and Carl A. Meissner; directors, L. K. Armstrong, W. S. Hutchinson, H. A. Guess, S. W. Mudd, and R. H. Sales.

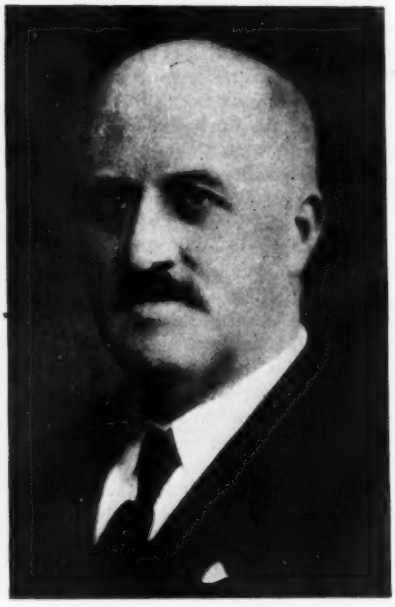
Mine ventilation, nonferrous metallurgy, milling and concentration, nonmetallic minerals, mining methods, coal, iron and steel, industrial relations, and petroleum were the leading subjects of addresses and discussions at the meeting. Carle R. Haywood spoke of the effect of zinc oxide on the formation temperatures of ferrous slags, referring to higher temperatures at which lead furnaces are being operated due to the improved apparatus for taking care of fumes which permit higher zinc in the slag. G. E. Dalbey spoke of operating a small circular furnace on brass ashes high in zinc. E. P. Mathewson spoke of the early practice in Colorado, and said the secret of success in running high zinc slags is to have no sulphur present.

The leaching of mixed copper ores with ferric sulfate by the Inspiration Copper Co. was described by G. D. Van Arsdale, and E. F. Kearn read a paper on the electrolytic separation of silver and gold.

Treatment of Telluride-bearing gold ores was described by W. A. Mueller, and M. H. Merriss spoke on electrolytic copper refining by the Nichols Copper Co.

Mining Geology

Interesting papers and discussions were read and had on mining geology subjects, in which W. H. Emmons explained his theories of the zonal deposition of ore bodies. L. C. Graton participated in this discussion, saying the value of microscopic work had been underestimated and broad generalities had been too freely accepted. Papers were read on the geology of mining districts in New Mexico and Ecuador and on lead and zinc in eastern Canada. The latter deposits were said to be similar to those in the Adirondacks in New York. Electrical and electro-magnetic prospecting as developed by Hans Lundberg was favorably commented upon.



Samuel Alfred Taylor

I. A. Ettlinger spoke of ore deposition and enrichment at the Magma mine at Superior, Ariz.

It was brought out that metal-mining companies should anticipate legislation regarding mine ventilation by making suggestions for improvements, rather than place themselves in the position of opposing legislation. Progress in metal-mine ventilation during the past 10 years was reviewed by G. E. McElroy, saying it had increased the efficiency of workers 100 percent. A. S. Richardson, ventilation engineer of the Anaconda Copper Co., spoke on theoretical rating as compared with operating performance of mine fans.

More than 50 addresses were made on petroleum topics. E. L. DeGolyer, of the Amerada Petroleum Corporation, predicted a decline in oil production. Taxation and the oil industry was discussed by A. B. Brokaw, of New York. He said many oil companies paid more taxes than dividends. State taxes were more burdensome than the Federal. The oil industry seemed to have been singled out for attack by the states.

Reports were made on mining methods in the Grass Valley district and in Mexico which showed details of operation and costs. F. W. Sperr described the use of scrapers in Michigan copper mines.

C. M. Haight spoke of drilling at the mines of the New Jersey Zinc Co. emphasizing the importance of control of temperatures in tempering drill steel.

The meeting was closed with a banquet at the Waldorf-Astoria, at which Wilbur Nelson, state geologist of Virginia, was toastmaster.

A survey of petroleum refineries, made by Bureau of Mines, shows a total of 508 refineries in the United States on January 1, 1926. Of these, 352 refineries, with capacity for treating 2,560,000 barrels daily, were being operated, while 157 refineries, with a total capacity of 290,000 barrels daily, were shut down. In addition, two refineries, of probable aggregate future capacity of 50,000 barrels per day, were under construction.

A similar survey made by the Bureau of Mines as of January 1, 1925, showed a total of 541 completed petroleum refineries, with a total daily refining capacity of 2,827,000 barrels, and six refineries, with a total capacity of 37,000 barrels per day, under construction. On January 1, 1921, there were 415 completed refineries, with a total capacity of 1,889,000 barrels, and 44 refineries, with a total capacity of 77,000 barrels, under construction.

Of the total number of completed plants, 289, of 830,000 barrels capacity, are skimming plants making gasoline, kerosene and gas and fuel oils. The greater part of the remaining capacity is that of complete plants, the relative percentage of which is steadily increasing. Approximately 150 plants have cracking equipment, the total charging capacity of which is probably in excess of 900,000 barrels per day.

The results of this census are given in "A Directory of Petroleum Refineries in the United States, January 1, 1926," compiled by G. R. Hopkins, petroleum economist, copies of which may be obtained from the Bureau of Mines.

HOOVER COMMITTEE MAKES RECOMMENDATIONS

Advisory Committee Appointed By Secretary Hoover Makes Report On Reorganization And Coordination Of The Activities, U. S. Bureau Of Mines—Designed To Simplify Contact With Mining Industry And Handle Mining Problems With Greater Efficiency

SHORTLY after the transfer of the Bureau of Mines from the Interior Department to the Department of Commerce, Secretary Hoover appointed an advisory committee to investigate the work being carried on by the Bureau, with a view to greater coordination of its activities in order that the mining industry might be better served. This committee is composed of John V. W. Reynders, President American Inst. M. & M. Engineers, chairman; C. P. White, representing Department of Commerce; F. P. Hanaway, representing United Mine Workers; D. M. Folsom, representing American Petroleum Inst.; Louis S. Cates, president American Mining Congress; J. G. Bradley, National Coal Association; H. Foster Bain, former director Bureau of Mines.

Their recommendations just have been issued and are as follows:

Mining is one of the greatest basic industries. It is not too much to say that the very existence of present day economic life among the more highly industrialized nations, rests upon the continued production and consumption of the energy producing minerals used as fuels, and of metals and non-metals. It is because the free use of fuels and metals permits the highest known production of useful goods per unit of human energy, that there is in the United States and parts of Europe the largest amount of distributable goods per capita ever known over any considerable period or area. Unless the world is prepared to return to the limited and localized life of the Middle Ages, the business of mining, treating, and using minerals must be jealously protected. It is not merely, for example, that coal, the mainspring of industry, and steel, the framework of modern civilization, permits the making of tools, building of houses, of bridges, of ships, and of railways, but mining itself furnishes the largest element in trade. The raw materials from the mines supply 52 percent of the freight carried by the Class A railroads of the United States, and with the products of first stages of manufacture, 68 percent. Coal, to cite a single example, has long been the balance wheel of British over-seas trade and ills of the coal industry and of that trade is coincident. In every way the production and use of minerals on an enormous scale is tied into our modern life.

The output of pig iron has increased in the United States in the past fifty years seventeenfold, of coal fourteenfold, of copper thirty-sixfold, of petroleum one hundred and tenfold. To supply our demand for the various minerals the output must be doubled every 10 to 20 years. It is clear that as a people careful thought must be taken as to elimination of waste in the mineral industries if the future is to be safeguarded.

With this great increase in production, and as one feature of the necessary

Hon. Herbert Hoover

speeding up and mechanicalization of industry there has also come about a disquieting increase of hazard reflected in high accident rates.

Position of Mining Industries

The mining industries, as a group, occupy a peculiar position differentiating them from either agriculture or manufacturing industries, in that they are based upon limited natural resources which, when exhausted, cannot be reproduced. This fact makes necessary the application to mining of public policies which do not ordinarily apply to other industries. It also makes desirable the segregation of government administrative, regulative, and promotive functions with reference to mining from those with reference to other branches of industry. In most highly civilized countries this fact has been recognized and a Minister of Mines or his equivalent in rank occupies a responsible position in the government.

Reorganization of Bureau of Mines

Transfer to the Bureau of Mines of the Division of Mineral Resources, which as a part of the Geological Survey has long maintained an important statistical service for the mineral industries, and placing the whole in the Department of Commerce where the economics of industry and trade are under constant review, affords an excellent opportunity for developing the further usefulness of the Bureau of Mines in an important direction. It will not be satisfactory to attempt to segregate economic studies entirely from the technologic and engineering aspects of these industries. Economic policy relating to minerals must be based on a wide knowledge of technical and engineering facts and conversely the direction and intensity of technical studies must be related to the economic situation in the industry.

Economics and Statistics

Your Committee believes that the interests of the several mining industries concerned can be best served by the Department of Commerce by a consolidation of relationships within the Bureau of Mines and therefore recommends the incorporation of a branch of Industry or Economics within the Bureau of Mines and the transfer to the Bureau of Coal, Minerals and Petroleum Divisions' work of the Bureau of Foreign and Domestic Commerce, with any others involved, to the extent that the officials of the Department may deem it wise or necessary for the accomplishment of this purpose.

For all these reasons, and the practical administrative advantages of centralizing work as far as possible it is believed that correct procedure points to building up in the Bureau, parallel to the present technologic branch, of an Industrial or Economic Branch of the service. To this branch should be transferred such units of the present service as are pertinent together with certain of those now maintained by other Bureaus in the Department.

While details of organization may properly be left to the consideration of those who must make them effective, the scheme below may be suggested. (See chart, page 191.)

Duplication in Activities

It is the belief of your Committee that the duplication of work now existing

among bureaus in the Department of Commerce is much less than is generally thought. We find that this particular form of waste has received special attention among the bureaus of the Department, as it has also between Department of Commerce bureaus and those of other Departments in many cases. Thus, voluntary action has minimized duplication of effort, even in cases where there has apparently been Congressional authorization of overlapping jurisdiction. Continuing studies of possible existing or threatened duplication should be made, however, and constant vigilance exercised to prevent new cases arising. We believe that coordination of the work of the various bureaus can be effected by the respective heads, and if necessary, in consultation with the Advisory Committee. We recommend that the matter be called to the attention of the officials of the Department, to whom we believe the responsibility for effective internal organization and administration can be safely intrusted.

The best guiding principle in determining allotment of work as between Mines and Standards, one field of difficulty will be to throw on the Bureau of Mines responsibility for studies relating to the raw and semi-finished minerals and mineral products and to preserve its character as essentially a field organization. Testing finished materials is a function of the Bureau of Standards as is also the higher physical study of all materials to determine constants and the constitution of matter. Under existing practice the Bureau of Mines has been studying, for example, the production of iron ore and the process metallurgy of iron and steel; the Bureau of Standards has studied physical metallurgy and the specifications for iron, steel, and steel products. This has worked well in practice and utilized to the fullest feasible degree the facilities and special knowledge of the two bureaus and a similar line of demarkation may well be followed in other fields. In this special instance the correct dividing line can be easily visualized if it be remembered that Mines is concerned with processes and Standards with products.

With the transfer recommended, of the Coal, Petroleum and Minerals Divisions of the Bureau of Foreign and Domestic Commerce to the Bureau of Mines, such a consolidation of relationships will be established as should best serve the interests of the several mining industries concerned in the work of the Department.

Safety

The Committee recognizes the outstanding importance of the safety work of the bureau, and pending a more complete study of the work, the Committee makes the following minute:

Since the establishment of the Bureau of Mines, one of the important divisions has been the Division of Safety. The work of this Division has probably been more widely known and had a more popular appeal than that of all the other divisions combined, because of the humanitarian activities in which it was engaged. Because the laws and regulations governing the actual production of coal are those of the local political divisions in which the mines are situated, the Federal Government is prevented from exercising any legal authority in the matter of safety regulations both as to the protection of life and property. The work of the Division, therefore, has had to be supplementary and auxiliary to the organizations set up in the various states for the supervision of mining operations. Its performance is a matter of public record, of which those who have been connected with it can justly be proud. Its efforts have been in the past largely advisory and educational and so must continue in the future. This does not mean that the work of the Safety Division need be in any way ineffectual; in fact, its accomplishments as an educational force can be more effective and far more powerful than if it were clothed with police authority. Because of the limitations placed upon federal safety service by our dual form of government, the object of the Safety Division should be the development of a public opinion within the various states for the creation of such standards of mine inspection and accident prevention and of such adequate facilities as will enable this bureau to turn over gradually to the individual states the work which properly belongs to them, in the meantime maintaining a high standard in its personnel and continuing unfalteringly its missionary endeavor toward the prevention of accidents, its encouragement of an increasingly higher standard of safety, and the actual rescue work in cases of emergency.

Fuel Economies

The money spent by the bureau on fuels research amounts to $90,000, in round numbers, per year.

Of this one-third is spent in direct sampling, inspection and analysis of fuels purchased by the Government, the total purchases amounting to roughly $9,000,000 per year. This includes service for the Panama Canal, Shipping Board, War, Navy, Interior and many other departments, and cooperation with a few of the states.

Furthermore, the bureau makes specific surveys designed to effect economies in government power plants. For instance, at the Walter Reed Hospital in Washington, as a result of such studies, changes in equipment costing a few hundred dollars and changes in methods involving no cash, resulted in savings of $15,000 per year and made unnecessary a proposed expenditure of $35,000 for enlarged capacity.

Two-thirds of the appropriation is spent on general research on fuels often necessary as a preliminary to the specific tests needed by the Government, but also designed to be basic and of general application. A few of the fields are:

(a) Methods of testing fuels. This found its inception in the boiler tests and gas producer tests at St. Louis and has resulted in a vast improvement in the methods, devices, and accuracy of fuel testing. Bureau of Mines standards of sampling at the mines and of testing are now the recognized basis of work in all progressive organizations and are so generally accepted in text books that their origin is forgotten.

(b) The Bureau of Mines gave impetus to the use of coal in the powdered state and helped to establish the resulting processes in the confidence of the public.

(c) At a total cost of two-thirds of the sum appropriated by Congress—one-third being returned unused—the bureau developed a method and device for converting North Dakota lignite into a smokeless domestic fuel on a commercial basis.

(d) Through the work of Burrell, Fieldner and others it developed a wholly new body of knowledge of the gases from coal which is effective also in such fields as the making of gas masks for mine and firemen's work; protection of people generally from monoxide poisoning from heaters and autos; ventilation of the New York-New Jersey tunnels, and many other directions.

(e) Smoke preventions studies have been made in cooperation with Salt Lake City, Grafton, W. Va., and other cities and have demonstrated that large industrial centers can, if they will, burn bituminous coal with substantially no smoke, save in the case of small domestic heating plants and even there the practice can be greatly improved.

(f) The bureau has conducted and is conducting fundamental studies on the constitution of coal of which Committee D5 on Coal and Coke of the American Society for Testing Materials says:

> "It is altogether likely that if we knew of what coal is actually composed, could identify the different chemical compounds in coal, that many of our present problems would disappear; problems such as the cause of spontaneous combustion of coal, mechanism of the coking process, what are the conditions for

making the best coke or the most gas."

It is unlikely that any individual company or trade association can or will finance such fundamental investigations; the United States Government, not only "to promote the general welfare" but also as *the largest owner of coal lands in the world* can and should do so on a far more generous scale.

Mining Methods

Study of mining methods as regards safety, efficiency and conservation of material has properly occupied much of the attention of the staff of the bureau and absorbs roughly 12½ percent of the funds. The study and development of mine rescue apparatus is a function of the Safety Service. The admirable system of permissible explosives and machinery is partly administered under the Chief Explosives Engineer and the Chief Mechanical Engineer. The bulk of the studies of mining methods are conducted by the Division of Mining Research. The Chief Mining Engineer acts as advisor to the director in all lines related to mines. The work of the Division of Mining Research is directed to the development and introduction of safer and more efficient mining methods. It is accomplished in large part through the part time use of engineers who have also other duties, such as supervision of or participation in the work of the Safety Service, or who form part of the staff of the various mining experiment stations. A smaller number of engineers devoted to this single purpose might be more effective from this point of view though it is undoubtedly advantageous to the work of the bureau as a whole to have these more advanced research mining engineers scattered throughout the organization.

The organization of the studies of fundamental functions and problems rather than of districts is commended and it is not considered desirable that the publication of a series of detailed descriptions of the methods of particular mines or districts be undertaken by the bureau.

Non-Metallics

The minerals of the non-metal group, excluding those used for fuels, now produced in the United States, exceed in value that of the metal output, and amount annually to three-quarters of a billion dollars or more. The total is made up of the output of many small mines, non-metallic mining being usually not organized with large producing units. In general, the industry corresponds rather to farming in that there are numerous small producers selling their output locally and in many instances operations are intermittent. Indeed, a surprising amount of production comes from the farm, the mining being done by farm labor as out of season work.

Proposed Reorganization Chart for Bureau of Mines

ASSISTANT DIRECTOR	DIRECTOR	ASSISTANT DIRECTOR
Technologic Branch (Organized on a functional basis)	Executive and Administrative	Economics Branch (Organized on a Commodity basis)
DIVISIONS OF		DIVISIONS OF
Mine Safety Board and Experimental Mine		COAL (including fuel products of coal and the Government Fuel Yards)
Mine Safety Service	Assistant to Director	PETROLEUM (including Petroleum products and natural gas)
Miners' Health and Sanitation		MINERALS AND METALS, Sections of: Iron ores, Copper, Lead and Zinc, Precious Metals, Rare Metals, Clays and other ceramic materials, Other non-metallics.
Mining Experiment Stations		
Mining research		
Metallurgy and Mineral Technology	Office Administration	
Mechanical Engineering		
Petroleum Engineering		
Explosives Engineering		
Helium	Information Service	STATISTICS

The non-metallic minerals used in industry are numerous and varied. They range from abrasives to soapstones. They vary greatly in characteristics and quality and are utilized in highly technical manufacturing industries, regarding which the initial producer has little information. It is characteristic of this field that grading of output is rudimentary and much of the material, gathered in small lots, is sold through brokers. Continually new uses are being found and undoubtedly new sources of supply of better quality or better situated for production, remain to be discovered and developed.

The non-metals constitute the great reserve of the mineral wealth of the nation. Long after the forests and the iron, lead, zinc, and copper deposits prove inadequate, brick, stone, slate, gypsum, lime, sand, gravel, and many other of the non-metallic minerals will be available in abundance for structural and other uses. At the same time, even now, our great manufacturing interests are at times handicapped by the inadequacy of local supply of suitable quality of some little considered non-metallic mineral such as garnet or mica.

For these various reasons there is in the non-metallic field a peculiar opportunity for usefulness in (a) research directed toward extending knowledge of the various minerals, and (b) collecting and redistributing such technical and economic knowledge as already exists. In the latter field especially the various trade journals and the trade associations that are coming into being are doing excellent work and in these as in other mineral industries there are individual producers and groups of producers who have well qualified and well directed technical staffs that need little outside help. This is not, however, true generally and much good can as usual be done in bringing average performance, as nearly as may be, up to the best performance.

In the main, but not always, the mining problems in the non-metallic industry are simple. They tend inevitably to become more complex as the favorably situated surface deposits are exhausted and in time the highest skill of the miner will be generally, as it is now frequently, needed. Already, the limestone industry is changing rapidly from quarrying to under-ground mining. Fluorspar and many other of the less well known non-metallic minerals are mined and yet, because of the history of its development, those now in the non-metallic industries seldom have that basic knowledge and experience in mining that is widespread and fundamental in metal and coal mining.

In the preparation of the non-metallic minerals for the market the processes of sorting, crushing, sizing, grinding, blending, and grading are all common processes of ore dressing. Wet and dry concentration, leaching, and flotation, all have their field here. Drying, roasting, sintering, and even smelting are also familiar processes. Indeed, a blast-furnace may be run, according as local economics dictate, to make either iron, cement, or fertilizer the main product with the other two secondary; and machinery developed for metal mining or treatment is constantly finding use in non-metal production.

For all these reasons there is proper scope here for Government help and a

direct responsibility rests on the Bureau of Mines. The transfer of knowledge from the mining and treatment of metal and coal to the field of non-metallic production and utilization is a natural and economic step in development of the wealth of the nation. In many instances, such as the production of refractories for metallurgical industries, it can only be done effectively by those familiar with the needs of the industry to be served as well as the one serving.

The intent of Congress that the Bureau of Mines should serve the whole mineral industry, including non-metallic production, is made abundantly clear in the organic law and in the wording of the supplementary Foster act. The acute needs of the coal and metal miners, however, led to first attention being concentrated elsewhere. The bureau entered the field with studies of radium in cooperation with the National Radium Institute. At a cost of $370,000, it not only developed a new method but acutally produced radium worth then just a little under $1,000,000. Of this the Government expenditure was $30,000 and the share of the output allocated to the Government was worth $215,000. Helium production, taken up later, was another great national service rendered by the bureau, and the development and test in actual service of graphite crucibles made from domestic material was another. The similar production of a dolomite refractory through actual plant research, now nearly completed, is another illustration of the value of carrying direct into the industry of the technical skill of the staff of the bureau.

In connection with the statistical service of the Geological Survey, now a part of the Bureau of Mines, and in response to a multitude of inquiries addressed direct to the bureau, there has grown up an Information Service at Washington which serves a wide need, especially in connection with the non-metallic industries and which, to meet its demand, continually requires the making of small researches. In the past these were conducted at the various field stations of the bureau as proved most convenient in each case but, since 1917, the work relating to ceramics proper has been centered mainly in the station at Columbus, Ohio, and, since 1922, the greater part of the other work on non-metallics has been done at a specially equipped experiment station conducted in cooperation with Rutgers College at New Brunswick, N. J.

It has been characteristic of this branch of the work that purely laboratory work has been subordinate. Field and plant research have been dominant and a large portion has been done in cooperation with the industries concerned. A field laboratory car has at times been used to advantage, being equipped with proper instruments and with living accommodations for a crew so that it may be switched into a works or at a plant wherever situated and 24-hour tests run with the minimum of expense and inconvenience. Such tests, which have been conducted through nearly two years at the joint expense of the bureau and five important associations of producers, have already pointed the way to elimination of waste and improved practice to a value many times the cost. A wide field for similar studies exists in many other lines than those already served, and the various industries should be awakened to the value of such research.

In correspondence and discussion with representatives of 18 trade and producers associations operating in the non-metallic field, it has become clear that these associations are distinctly favorable to the continuance of the activities of the work of the Bureau of Mines and are disposed to cooperate freely with it. Minor criticisms only are made; mainly, to the effect that not enough is done, as where a more minute classification in the statistical work is asked. Prompter returns are also wanted, delay in publishing results being one of the general criticisms made. Since, however, the printing funds have been reduced and the printing itself is not in the hands of the bureau it is difficult to suggest any means of meeting this criticism wholly. The letters received indicate a distinct tone of uneasiness lest, in reduction of expenditure, work believed to be fundamental to sound development of American industry be hampered, or in readjustment of administrative lines the distinctly laboratory point of view be overemphasized as compared with the past practice of concentrating on field and plant research with the laboratory in the background as but one element in the research. It is also clear that the various industries served will gladly join in perfecting programs of research, in furnishing plant facilities, in disseminating the results, and where able, in actual part payment of salaries and expenses of a staff jointly assembled.

The work of the Bureau of Mines for the non-metallic industries evidently enjoys the high confidence of those it has served.

Metallurgy and Ore Dressing

We believe that the major portion of the bureau's technical work should be devoted to fundamental problems of wide application. Among the reasons for this are that private enterprises are concerned chiefly with problems peculiar to their own properties and are not directly interested in the dissemination of results of their experiments; that the bureau is or can be equipped to cover a wider range of investigation than any private concern does or is likely to cover and that the bureau has and will have access to more information from more localities than any private organization has or is likely to have. Any progress achieved along fundamental lines will be of greater public benefit than work on some special or local problem. Therefore, we believe that the bureau should devote at least 60 percent of its activities to the fundamentals and the rest to minor or local conditions.

Consolidation of Stations

It is recommended that the work of the small stations be consolidated into three units, located at Pittsburgh, Salt Lake City, and one at a point where the oil industry could be well served. Three stations so situated could be built up into efficient units where brains and apparatus could be consolidated under more efficient leadership and supervision than is possible with many small struggling units.

As to the subjects that should be investigated, there are so many fundamental principles that need development that we see no danger of the bureau finding it necessary to expend its energies on any subjects that would benefit comparatively few. An investigation once started should be carried to a final conclusion. By this is meant that there is no forbidden ground for the bureau; they should carry on until the process or development has been brought to an indicated commercial success, or definite conclusion if a purely technical subject. In other words, it would be better if all the appropriation were spent on one subject that brought forth a definite development than to dribble away small amounts on many subjects.

It is perfectly evident that the suggestion of abandoning the small stations will not be popular with the politicians or the heads of the institutions where the stations are now located. It would be better business to turn the stations over gratis to the institutions, for in the last analysis these stations were created, in a great measure, to get political support for the establishment of the bureau, and therefore have served their purpose. We see nothing in the argument that these small stations scattered over the country help disseminate information, etc. Those who seriously desire help or advice would not be deterred because it was necessary to correspond with a central station. If the subject needed personal investigation, an engineer could be sent out from headquarters.

Service to the Government

The organic act establishing the Bureau of Mines contains this phrase:

"and on behalf of the Government to investigate the mineral fuels and unfinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient mining, preparation, treatment, and use." This, and confirmatory clauses in various appropriation acts, including specific authority to receive funds on transfer from other bureaus and branches of the Government in payment for services, establishes what your Committee believes to be a sound principle, namely that within its scope, the staff and facilities of the bureau should be available to assist any branch of the Government in the solution of technical or industrial problems before it or, if otherwise desirable, in actual operations.

This has been the custom heretofore and in the current year, aside from the work of helium, service work for other departments and bureaus calls for expenditure of over $200,000, comprising nearly 10 percent of the money to be spent by the bureau. In part this is from funds appropriated direct to the bureau and in part is provided by transfer. It is believed that this policy should be continued and that the individual service jobs should be allotted to whatever division or section of the bureau is in each case best equipped to handle them and that the expense should in each case be divided between mines and the bureau asking the service in accordance with the equities of the particular circumstances; Mines paying from its funds for such portion as corresponds to the results likely to accrue that will form a part of its general studies of safety and efficiency.

The Bureau of Mines has no police power and no right to entry to mines or plants. Neither has it any mandatory authority giving it access to the books or papers of companies and industries. It depends on the cooperation and good will of the industries in collecting data. It is most important that this good will be not lost and that the confidential character of individual returns be respected in the fullest degree. Accordingly, it is recommended that neither the bureau nor members of its staff be used in connection with prosecutions by the Government or the States, for infraction of laws, or in determining damages in civil suits.

Petroleum and Natural Gas

The work of the Petroleum Division of the Bureau of Mines has been helpful and of direct value to the oil industry.

It has included:

(1) The collection and publication of statistics covering production and refining of petroleum.

(2) Investigation of operating methods within the industry with a view to reduction of losses in the production, storage, and transportation of crude oil and petroleum products—and dissemination of information in regard to improvements in operating practice.

(3) Research work into the characteristics of oils and products as produced in different fields and research in methods of distillation of oils and the treatment and utilization of products.

It is recommended that the collection of statistics be transferred to the proposed economic branch of the bureau and that the method of collection and form of publication of these statistics be carefully revised to make these figures more accurate and in consequence of greater value to the industry.

The investigation of operating methods has involved field work and the study of specific problems in different fields. It has, therefore, been conducted from stations established in the vicinity of oil fields. This work has been welcomed by the oil industry and has been of great benefit in many cases. It has led to cooperation between the bureau and various units of the industry, and in the investigation of individual problems. This direct contact between the bureau and operating companies has been particularly valuable. It is recommended that this field work in study of operating methods be continued and strengthened by careful planning and direction. More complete cooperation with the industry should be secured through advisory committees and such other channels as are available.

Studies of the physical and chemical character and properties of oil have not been thorough or systematic. It is recommended that this work be concentrated at some central point and that it be confined to scientific research rather than the development of new processes or the improvement of existing practice in the refining and treatment of petroleum.

Collection and Dissemination of Information

It is the thought of your Committee that the results of the Bureau work should react to the direct benefit of the industries involved. It is apparent that each of the mining industries may have different ideas as to furnishing of information and divergent views as to the details to be given out by the Government; also that the Government may from time to time desire access to information that would not be of direct or immediate commercial value. Therefore, we believe that, subject to the limitations imposed by appropriations available for this work, the Bureau should collect current figures showing production, sales, distribution, stocks and consumption, also costs, selling prices, realizations, etc., if desired by the industry concerned, and that such information should be tabulated and promptly distributed to all interested parties. We recommend that steps be taken to ascertain the wishes of representatives of the several mining industries in this matter so that plans for appropriate action may be taken as soon as possible.

Cooperation with Industry

While there is no specific wording in the statutes governing the Bureau relating to cooperation, it has been the practice from the first to make cooperative agreements with other Government agencies, states, cities, industrial organizations, and even at times with individual companies. The point of view of the Bureau staff, essentially that of a field engineer, has led to a feeling that the work was not complete until the results had been put into practice. Such a result is greatly facilitated through cooperative agreements at the same time that a proper part of the expense is assessed to those first and more immediately benefited. It is probably desirable that the field and scope of permissible cooperative agreements be authorized by law and that this be sufficiently broad to permit the readiest contact between the Bureau and particular mineral industries. It is highly desirable that the staff of the Bureau have at all times the advice and criticism of the industry and the system of advisory committees already in being may, we think, be extended to advantage to cover the initiation of various studies, the methods of their conduct, and the partial and final results. There should also be some better system of checking up on studies under way to assure either that progress is being made or the work stopped, and to that end it is recommended that special advisory committees representing the industries concerned be set up for each commodity and similar committees for each other branch or section of the work.

Publication and Exhibits

Promptness in publication of results is essential if they are to serve their purpose in industry. Much sound criticism has been made of the failure of the Government to recognize this and adequately to provide against deadening delay. The amounts made available for printing have been much too small and the rules under which the printing has been done have been hampering. It perhaps tells the tale adequately to say that with four times the funds for securing data, the amount available for presenting them to the public was actually reduced despite the increase in cost of printing that has taken place in the past 10 years.

Exhibitions afford an effective means of demonstrating processes to special

groups to whom they are of most interest, but, although it has been asked, no separate item to cover such expense has been allowed and such participation in trade-shows and industrial exhibitions as the Bureau has undertaken, has been at the expense of its research funds. Recently, even this has been substantially prevented by decisions of the Comptroller-General.

Motion Pictures

Motion pictures are generally recognized as one of the best means of getting before the public sound ideas of efficiency and safety in industrial processes. The Department of Agriculture maintains a large laboratory and staff and numerous other branches of the Government spend many thousands of dollars annually on this work. Thanks to the generous cooperation of numerous trade associations, companies and individuals concerned with the mineral industries, a remarkable library of educational films relating to mining, metallurgy, and mineral technology has been collected by gift and is circulated by the Bureau at the expense of the exhibitors, among technical schools, professional societies, trade associations, and similar institutions; and in view of the fact that the public will not pay for such pictures in commercial theaters this work should be continued. The films now in circulation represent an expenditure of $800,000, of which the Government has never contributed more than $5,000 in any year. This work has received the hearty commendation of leaders in the profession, of educators, and of motion picture experts, but having been developed without specific warrant has been subject to occasional attack, which this Committee believes unfounded.

It is impossible with the limits of time and space here available for this Committee to review in detail the large amount of work heretofore done by the Bureau or adequately to express its appreciation of what has been accomplished. American industry is heavily in the debt of the members of its staff who, amid many discouragements, with inadequate salaries, and subject to most annoying limitations have, dominantly from love of their work, conducted the researches and service work that have been most important to the Government and to industry at large. More rather than less support is due this organization and closer contact of the industries with the Bureau should be effected in order that the greatest good be realized.

Appropriations

Careful study of the actual work of the Bureau and a less detailed study of other bureaus in the Department, led the Committee to the conclusion that it would be unwise to reduce appropriations because of the transfer of Mines to Commerce. If in the general and broad interest in reduction of expenditures it be felt necessary temporarily to reduce the sums to be allotted for any of this work, it should be recognized that the work itself will necessarily be reduced in equivalent amount. This is always possible in research, but it is also true that half an experiment is worth nothing and incomplete researches yield no returns. If it requires $20,000 to determine a matter, an appropriation of less than that amount is wasted money. One may build a small house rather than a large one if funds be inadequate but a small scale experiment on the explosibility of coal dust may be harmful rather than beneficial in results. With stiffening world competition in trade and the necessity for constantly increasing the mechanicalization of industrial processes in order to maintain our output and simultaneously our immigration policy, with the growing necessity to use lower and lower grade materials and to practice closer and closer economy in production, this is no time to withdraw from industry any technical service the Government now gives. By readjustment and closer coordination the funds can be made to accomplish better service, but reduction of expenditure will necessarily mean dropping work. Nothing is less economical than under financing and if the officers of the Department are to discharge the duties toward industry laid on them by law, they must have the funds necessary to the collection of data, performance of experiments, study of results, and dissemination of the information.

EXPLOSIVE CONSUMPTION

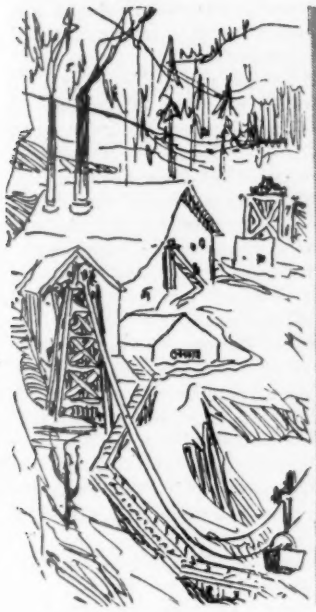
A TOTAL of 58,380,217 pounds of permissible explosives was consumed in the United States in 1925, according to preliminary reports made by manufacturers to the Bureau of Mines. Final reports will probably show an increase of 6 percent in sales of permissible explosives in 1925 as compared with 1924. Ninety percent of the total amount sold in 1925 was for use in coal-mining operations. During the entire year the consumption of permissible explosives at bituminous coal mines averaged 77 pounds out of 325 pounds, or 24 percent of all kinds of explosives per thousand tons of coal produced. In anthracite mining the consumption of all kinds of explosives averaged 702 pounds per thousand tons of coal mined, and of this amount 195 pounds, or 28 percent, were permissibles. Permissible explosives include ammonium nitrate explosives, hydrated explosives, organic nitrate explosives, and certain nitroglycerin explosives containing an excess of free water or carbon. All permissible explosives have passed certain tests by the Bureau of Mines designed to determine their safety for use in gaseous and dusty coal mines.

Sales of black blasting powder during 1925 are reported to the bureau as being approximately 6,307,184 kegs of 25 pounds each. The amount of black powder sold in 1925 represents a decrease of 6 percent in comparison with 1924. Of the total reported sales of black powder during 1925 coal mines used 84 percent, metal mines 2 percent, quarries and nonmetallic mineral mines 4 percent, railway and other construction work 6 percent, and miscellaneous purposes 4 percent. The consumption of blasting powder in bituminous coal mines in 1925 averaged 230 pounds out of 325 pounds of all classes of explosives per thousand tons of coal produced. At anthracite mines the consumption of explosives per thousand tons of coal during the year averaged 702 pounds, of which 203 pounds, or 29 percent, were black powder.

During the year 1925 the total sales of other high explosives amounted to approximately 285,295,097 pounds. As compared with 1924, the amount sold in 1925 represents an increase of 4 percent. Of the total amount used, 10 percent was for coal mining, 33 percent for metal mining, 26 percent for quarrying and nonmetallic mineral mining, 15 percent for railway and other construction work, and 16 percent for all other purposes. The quantity used at bituminous coal mines during the year 1925 averaged 18 pounds of high explosives out of 325 pounds of all types of explosives consumed per thousand tons of coal produced during the year. At anthracite mines the average was 304 pounds of high explosives out of 702 pounds of all classes of explosives per thousand tons of coal.

In 1925 mills manufacturing black powder were operated at approximately 38 percent of their capacity as contrasted with operations on a basis of 41 percent of capacity in 1924. In 1925 mills manufacturing permissibles and other high explosives operated at the rate of 62 percent of capacity, which is the same rate as prevailed in 1924.

The Department of Agriculture, through the Bureau of Public Roads, distributed during 1925 a total of 14,214,750 pounds of pyrotol in various states, to be used mainly for land clearing and for road construction.



METALS

PRACTICAL OPERATING MEN'S DEPARTMENT

Practical Operating Problems of the Metal Mining Industry

SCRAPERS IN UNDERGROUND LOADING — DEVELOPMENT AND PRESENT METHODS

A Description Of The Uses To Which Scrapers Have Been Put In Moving Ore Economically Underground —Present Tendency Is Toward Electric Power Rather Than Compressed Air, And Toward Heavier But Not Larger Scrapers

By LUCIEN EATON*

THE first scraper outfits used underground were small slip-scrapers, or "slushers," of about 3 cubic feet capacity, hauled by small single-drum air-hoists. They were used for spreading filling-in stopes, for loading rock in drifts in conjunction with slides, and for putting ore into chutes in sublevel mining. Their most extensive use was in the soft ores of the Mesabi Iron Range in Minnesota, where the ore as broken was particularly well suited to their use. Some very good records were made by their use, the simplicity and flexibility of the apparatus offsetting the labor required.

Lucien Eaton

The next development was a small double-drum hoist driven by compressed air, having either a Dake engine or a turbine motor, and hauling a self-dumping, bottomless scraper of either the box or hoe type. These scrapers had a capacity of 8 cubic feet and weighed from 170 to 500 pounds. The engines developed from 4½ to 7 horsepower. These outfits became popular at once, but the demand for more power arose quickly, and as a consequence the horsepower of the engines was gradually increased until it has now been practically doubled.

At the same time larger outfits were developed, using larger scrapers and hoists with reciprocating engines developing 12 to 20 horsepower. These installations were not so many in number, but were scattered over a large area. The largest installation that I remember was at a mine in the old Joplin District, which produced a large daily output with scrapers weighing about 5,000 pounds each, which were pulled by hoists with 50 horsepower and 100 horsepower motors.

The present tendency is toward electric power instead of compressed air, and toward heavier, though usually not larger, scrapers. The small electric hoists develop 10 to 12 horsepower, and larger standard units are planned. Some mines have standardized on electric hoists with 25-horsepower motors. The increase in power makes possible the use of heavier scrapers, which in turn reduce the labor required and increase the safety of the operation. The growing popularity of the electric-hoist is justified by lower power cost, fewer repairs, and, in the larger sizes with separate motors, smoother operation, and greater flexibility in choice of speed and horsepower. Improvements in electrical equipment and the complete electrification of mines, which has been so widespread in recent years, have also helped to focus attention on the electric drive.

During the past few years the changes in scraping equipment have not been as marked as the changes in method of application. At first the equipment was developed to suit the methods of mining in use, but, as the possibilities and limitation of scraping began to be appreciated, mining methods were changed so as to provide the best working conditions for the equipment.

Scraping operations underground may be divided into three classes:

(1) Loading cars in drifts or tunnels.

(2) Scraping directly into chutes.

(3) Auxiliary scrapers feeding larger main-line scrapers, which in turn scrape directly into pockets or cars.

In loading cars in drifts a slide is

*Cleveland-Cliffs Iron Co.

used, and the ore or rock is hauled by the scraper up an incline and into a car. Some slides are mounted on wheels and some rest directly on the ground. Some are long enough for a train of several cars to be pushed under them, and some load only one car at a time. In a few instances cars have been so equipped with overlapping flanges on the ends and with guards at the sides that a whole train can be loaded without switching, the scraper being dragged along over the top of the cars. Not much progress in this kind of work has been made lately, probably on account of the reduction in development work in the iron and copper mines.

The increase in the number of scrapers used to move ore directly into the chute has in the past two years been remarkable. This is especially true in mines using the top-slicing system of mining. It has been found that scrapers can be hauled around a 60-degree turn without much difficulty, and methods of timbering have been changed to take advantage of this fact, and a system of radial slices from the chute has been the result. Another development has been the adaptation of scrapers to "inclined slicing," as developed in the copper mines of the southwest. In this method the slices are driven upward at an inclination almost steep enough for the broken ore to run at right angles to a narrow, square-set room or to a line of closely spaced chutes. If the ore is damp, the inclination of the slices is such that timbering is complicated and expensive, and it has been found advisable to substitute scrapers and hoists for the inclined slices. The system is therefore now "inclined slicing" without any inclines. When the capping and the strength of the ore are favorable to this method of mining remarkably good results have been obtained.

One of the most favorable conditions for moving ore with scrapers is in mines where the ore lies in a comparatively thin vein or bed on an inclined foot-wall, the dip of which is less than 40 degrees. Under such conditions the broken ore will not run by gravity, and has to be rehandled, sometimes several times, in being shoveled down the slope. The scraper is particularly well suited to solve this problem, and large savings have been made by scraping such ore directly into chutes.

The third classification of the uses to which scrapers are put underground, namely, that of auxiliary scrapers discharging their product in the path of a main-line scraper, was first developed, so far as I know, at the Oronogo Circle Mine in the old Joplin District. Here five 5½-foot scrapers dragged the ore from a large mass, broken by caving, to two similar scrapers, which were operated in two trenches radiating from the shaft. This was an exceptional development.

The next installation of this kind was at an iron mine, where the ore extended up a fairly flat foot-wall in "fingers" for several hundred feet above the level. Long chutes in rock and much rock-drifting would have been required to mine this ore in the usual way, as the foot-wall was too flat for the ore to run by gravity. The solution of the problem was a long incline on the foot-wall, down which the ore was dragged by one scraper, while the ore from the sub-levels was discharged into this incline by other scrapers. Without this method of moving ore it is doubtful if the mine could have been operated profitably.

It seems as if similar adaptations of scrapers to underground work might have a very extended use in metal mining and very probably in coal mining. Its use would cut down the amount of development work necessary in mines using top-slicing methods, and would make possible more intensive mining in small areas, simplifying supervision and increasing output per man. It seems to be one solution of the problem of securing a large product with mechanical loading in a small area in room and pillar mining. A combination of "inclined slicing" and scraping has been suggested for steep veins, and has many advantages, and it is only a step from this method to "double scraping," if it may be so called.

The above is a brief description of some of the uses to which scrapers have been put in moving ore economically underground. A great many men of great ingenuity and resource are working on this problem as it is presented to them under varying conditions in all parts of the country, and many new and successful applications can be confidently expected in the next few years.

SOUTHERN INDUSTRIAL CONFERENCE

(*Continued from page* 154)

a small proportion of the total number of other ores and clays, fuller's earth, bauxite, ochre, and various other kinds of clays and by-products which may be advantageously developed and manufactured in Southern cities.

"The sole purpose of this Conference is to acquaint Southern people with the enormous wealth trampled under foot by them daily, and the means whereby this potential wealth may be transformed into industrial development.

"The American Mining Congress is arranging the program, which will include representatives of all the Southern States, as well as mining engineers, capitalists, bankers, manufacturers, state and government officials and other business and professional men who are interested in the development of Southern industries."

The official call states that "The Conference will be composed of members of the American Mining Congress, and members of affiliated organizations, specially invited guests and duly accredited delegates appointed under the authority hereby extended for the appointment of delegates, as follows:

"Governors of States may each appoint one delegate from each county, and 10 delegates-at-large.

"Mayors of cities and towns, two delegates each, and one additional for each 10,000 of population.

"Boards of Trade, Chambers of Commerce, Manufacturers' Associations, Engineers' Associations, and similar organizations, may appoint two delegates each, and one additional for each 100 members.

"State Banking Associations may appoint 10 delegates each.

"Investment Bankers' Associations may appoint two delegates from each state.

"State Mining Schools may appoint two delegates each."

It is believed that the vision of an industrial empire, economically functioning because of the proximity of raw materials and manufacturing facilities, the splendid combination of equitable climate and unexcelled labor, with transportation available, and waiting ports, with the rapidly expanding markets in Latin America and the Orient, should be brought vividly before the bankers of the nation.

It is the endeavor of this conference and the organizations behind it to make the slogan of the conference a literal one in the South: "A smokestack is the workingman's best friend."

METAL MINE ACCIDENTS IN 1924

ACCIDENTS at mines producing metals and nonmetallic minerals (except fuels) in the United States in the calendar year 1924 resulted in 418 deaths and 33,118 nonfatal accidents, which disabled an employe beyond the day on which the accident occurred, according to returns made by operating companies to the Bureau of Mines. The fatality rate, 3.51 per thousand 300-day employes was 0.50 per thousand higher than the previous year's rate, mainly because of the loss of 41 lives in the Milford mine flood in Minnesota on February 5, 1924. The non fatal injury rate, 278 per thousand employes, was not materially different from the previous year's rate of 275. The fatality rate for the industry as a whole has shown a downward trend since 1911, the first year for which figures are available.

UNDERGROUND MECHANICAL LOADING AT UNITED VERDE

The United Verde Mine Has Been Carrying On Experiments With Scraper And Shovel Loading Since 1920 — This Article Gives Results Obtained Together With Costs

By W. V. De Camp *

EXPERIMENTS in mechanical loading at the United Verde mine have been carried on since 1920, although not continuously.

Ore bodies are large, individual stopes ranging from 20 ft. x 100 ft. to 100 ft. x 200 ft. Due to the strength of the backs of these stopes and their irregularity in grade and outline, they are mined by horizontal cut and fill methods in seven-foot slices. The removal of a horizontal slice of ore 7 ft. in thickness is followed by a horizontal waste fill of 7 ft. covered with 2-in. flooring. Ore chutes are constructed of 5 x 8 cribbing, 4¼ in. in the clear, covered with 60-pound inverted rails. Chutes are spaced from 20 to 25 feet.

The ore is a very hard iron sulphide with a specific gravity of 4.6 and weight in place of 200 to 250 pounds per cubic foot. Loose in a car or muck pile, the weight per cubic foot is approximately 130 to 160 pounds. The hardness of this ore, combined with its extreme toughness and great weight, is extremely severe on all mechanical equipment.

In place, the ore is cut by a sufficient number of seams to produce a maximum amount of coarse material after blasting. Exhaustive tests have been conducted with a view to breaking the material finer with the initial blast, but without success. These tests included various methods of spacing holes, combined with electrical blasting, either delayed or instantaneous, and since all efforts to break fine failed, we ultimately adopted our present method which includes standard breast stope rounds designed to break material coarse, after which the coarser pieces are block-holed or in some cases broken with a hammer to pass the grizzlies. Ore is shovelled by hand to the various chutes, and if large pieces are encountered, the shoveller works around them until they are drilled and blasted.

In 1919, a Marion 28, 5/8 cubic yard, electric operated shovel was introduced in one of the larger stopes. This shovel was operated for about one year with the hope that cost of hand shovelling could be attained or that a cost could be reached which would assure the efficiency of the equipment and permit much wider spacing of chutes, which would have resulted in a decreased timber cost. As indicated in photograph (1), the shovel was mounted on wheels and a mat of heavy ties carried to prevent sinking through the 2-in. flooring into the loose waste below. Current was supplied by a flexible cable. Ore was dumped into 18-cu. ft., box type, side-dump cars, running on 16-pound sectional track.

* Gen. Supt. United Verde Copper Mining Co.

Marion, Model 28, ⅝ cubic yard electric shovel operating in a stope at the United Verde mine

The following assumptions regarding the operation of this equipment were made prior to the final test run:

Unit Costs for One-shift Operation (Minimum Crew)

Labor:		
Operator @ $262.00 per month of 28 working days		$ 9.36
Two carmen @ $5.60		11.20
One chuck @ $5.85		5.85
Total labor cost per shift		$26.41
Interest and Depreciation:		
Original cost	$11,000	
6% on investment for 3 years	1,980	
3 years of 12 28-day months equals 1,008 days.		
Total depreciation per day		$12.88
Moving:		
4 times a year @ $150 equals $1,800		
Tota per shift		1.78
Repairs:		
Labor—2 shifts each month for 36 months	$1,901.52	1.89
Material—assumed		1.00
Total cost per day		$43.96

Bonus:

For operator, 10c per car for all over 70 cars per shift.

For others, 2½c per car for all over 70 cars per shift.

Output	Cost per car, including bonus: Labor	Fixed Charges	Total
70	$ .377	$ .250	$ .627
75	.363	.234	.597
80	.352	.219	.571
85	.342	.206	.548
90	.332	.195	.527
95	.323	.184	.508
100	.317	.176	.493

On completion of the test, the following figures were taken from the best five weeks of operation:

Days operating	32
Cars of ore moved	1,604
Cars of ore moved per day	50.2
Days down for repairs	2
Days down for moving	2
Days down no power	1
Cars moved days operated	57.4

	Total Costs	Cost Per Car
Operator	$279.04	
Helper	268.40	
Carmen	515.20	
Bonus paid	13.60	
Total	$1,076.24	$ .67
Depreciation @ $12.88 per day		.25
GRAND TOTAL		$ .92
Cars per man per day		10

When shoveling by hand, cost is 28 to 30c per ton.

Saving by spacing chutes 50 feet apart:

	Shovel	Hand
Labor and Depreciation	$ .92	$ .30
Timbering	.14	.42
Total	$1.06	$ .72

When digging, it was found that the shovel was unable to dig into the pile of broken ore if a boulder of any size

was encountered, and once the face was cleaned of all loose material, it had to be delayed until rock could be drilled and blasted. The hand shoveller, however, could move from 10 to 15 cars per day by virtue of his ability to work around large boulders which could be blasted at noon or on going off shift.

In January, 1921, the shovel was dismounted and moved to the surface.

During 1920, one Armstrong Shuveloder was placed in a long drift on the 500-ft. level and was removed after 90 days of operation due to the necessity for breaking the drift larger if the machine were to operate satisfactorily. This machine would not operate in a 5 x 7 ft. drift.

COSTS AND DELAYS

Place	500 Drift
Days	90
Repairs	42 minutes
Moving	22 minutes
Track	39 minutes
Cars	18 minutes
Net Run	4 hours, 29 minutes
Cars	27.7
Number Men	2
Cars per hour	6.16
Cars per man per shift	13.85
Cost per car including power and depreciation	53c

The above costs did not include a tram of 1,000 feet.

On completion of drift test work, one of the large cut-and-fill stopes was prepared with the necessary track, and experiments with the Shuveloder continued over a long period of time.

Average performance on this work and average delays were as follows:

May—Shifts, 44; Repairs, 22 minutes; Moving, 17 minutes; Track, 40 minutes; Cars, 29 minutes; Plugging, 17 minutes; Run Time, 4 hours 25 minutes; per man, 10.7.

June—Shifts, 54; Repairs, 53 minutes; Moving, 19 minutes; Track, 28 minutes; Cars, 32 minutes; Plugging, 22 minutes; Run Time, 3 hours 56 minutes; per man, 9.3.

July—Shifts, 46; Repairs, 39 minutes; Moving, 29 minutes; Track, 25 minutes; Cars, 48 minutes; Plugging, 4 minutes; Run Time, 4 hours 5 minutes; per man, 10.85.

August—Shifts, 50; Repairs, 24 minutes; Moving, 12 minutes; Track, 18 minutes; Cars, 25 minutes; Plugging, 14 minutes; Run Time, 4 hours 57 minutes; per man, 10.12.

Average—Shifts, 194; Repairs, 37 minutes; Moving, 19 minutes; Track, 21 minutes; Cars, 33 minutes; Plugging, 15 minutes; Run Time, 4 hours 37 minutes; per man, 10.17.

Average cars per hour of running time	5.1
Average cars per man—shuveloding	10.17
Average cars per man—hand shoveling	14.2

This shovel encountered the same difficulty as the larger electric shovel.

Time lost due to repairs is low since two shovels were maintained to do the work of one. One shovel costing $3,000.00 was completely worn out in four months, or a depreciation cost of 70c per car for the 4,315 cars handled.

For three years we used Shuveloders wherever conditions would permit, but found that repairs and moving caused delays that required a spare machine in reserve at all times.

Scraping Experiment

Experiments with scrapers of various types, operated by double-drum hoists varying from 7½ H. P. to 35 H. P. for underground use, were as follows:

I. 7½ H. P. to 15 H. P. double-drum hoists (3 makes) scraping heavy, coarse iron ore in incline cut and fill work.

II. Scraping waste down incline air raise, inclination of 37° from horizontal.

III. Scraping waste in horizontal cut and fill stopes.

IV. Scraping hard, coarse sulphide ore in horizontal cut and fill stopes.

V. Scraping sill floors of stopes where sills were cut on fourth floor and material dragged into wing raises.

VI. Scraping in long drifts equipped with mounted double-drum hoist scraping up an incline into cars.

I

Scraping sulphide ore-incline slice:

Type of hoists—3 makes of double drum hoists.

Rope speed—75 to 125 feet per minute.

Hoe and Bagley type scrapers.

Experiment a dismal failure due to high specific gravity of material and coarseness which required block-holing in most cases.

II

Scraping waste in incline raise.

A condition existed here with a 37° incline in hard ground where a 7½ H. P. double-drum hoist with Bagley type scraper operated satisfactorily, since scraper operated on the rock bottom, forming a trough in the loose muck.

One man handled all waste to a pocket at the bottom of the raise.

This was a special case, since all other raises are driven at an inclination of 55° or over.

III

Scraping waste in horizontal cut and fill stopes.

Dimension of stope—100 x 150 feet.

No. of waste raises—2.

Type of hoist—Double-drum, 6 H. P.

Rope Speed—75 to 125 feet per minute.

Scraper—Slip type, capacity 2.68 cu. ft.

Location: The waste was spread from piles dumped from the 9-N and No. 2 waste raises in the 1800 10-0 No. 2 stope. Both of these being on the pillar line, it was possible to scrape from one side only.

Cost of Scraping: Labor used was two timber helpers on each shift, the work being done on the day shift only.

Installation and moving hoist 3 times	$23.94
Labor spreading waste	257.60
Total	$281.54
Number of cars of waste spread	1,325
Cost per car	$0.210
Cost per ton of ore extracted	0.105

The equipment was then changed to another make of double-drum hoist rated at 6.5 H. P., with rope speed under maximum load of about 60 feet per minute, and with empty scraper about 100 feet per minute. The second scraper used was locally designed and built, with a capacity of 7.5 cu. ft.

COST OF SCRAPING

Labor cost for three shifts	$28.08
Number of cars of waste spread	150
Cost per car	$0.186
Cost per ton of ore extracted	0.093

Discussion

Slip Scraper: This type of scraper is not adapted for our use in stope work for two reasons; namely, (1) It is not adapted for handling coarse material and does not dig into the side of a pile. (2) The capacity of this scraper was so small that had it not been used to fill a portion of the stope where the maximum haul with a load was not over 30 feet, the cost would have been considerably higher.

Locally Designed Scraper: This scraper was designed to be operated by the hoistman without assistance, the object being to design a scraper that would automatically load and dump itself. It proved to be a self-dumper, but required an extra man to steer it into the pile and balance it while picking up the load. As a one-man scraper, it was a failure, but had the capacity of the hoist used been greater, it might have been possible to have designed a larger scraper of the same type which would have reduced the present cost of waste spreading. The work done with this scraper was with a minimum haul of not less than 30 feet, which tended to increase the cost.

Hoists: The second hoist proved to be the best for scraper work, the chief reasons being that it seemed to develop more power under full load than the Ingersoll Tugger, and the brake and clutch arrangement was more satisfactory.

Recommendations

These experiments were not carried far enough along to warrant a definite recommendation. The hoists used were too small to handle an economical load. Possibly a more powerful hoist with a larger scraper would prove successful.

IV

Scraping sulphide ore in a horizontal cut and fill stope.

Type of hoist—Tandem, double-drum, 35 H. P., 250-volt D. C. electric hoist with outside brake and clutch.

Scraper—Bagley type with a capacity of 11 cu. ft.

LABOR

Hoistman:	36 shifts @ $5.75	$207.00
Miner:	36 shifts @ 5.45	196.20
Mucker:	19 shifts @ 4.84	91.96
Total		$495.16
Deductions due to delays:		
1 day 3 men repairing hoist	$16.04	
2 days 2 men repairing hoist	22.40	
Total	$38.44	38.44
Actual charge against scraper		$456.72
Total number cars drawn from stope chutes		816
Capacity of car		1.2 tons
Total number tons drawn from stope chutes		979.2
Tons per shift		29.6
Tons per man shift		12.7
Cost per ton of ore handled by scraper		46.6c

The second period of this test gave the following results:

LABOR

Hoistman:	27 shifts @ $5.75	$155.25
Miner:	27 shifts @ 5.45	147.15
Total		$302.40
Deductions due to delays:		
1 shift 2 men repairing hoist	$11.20	
2½ shifts 2 men barring down	28.00	
Total	$39.20	$39.20
Actual charge against scraper		$263.20
Total cars of ore drawn from stope chutes		641
Capacity per car		1.2 tons
Total tons of ore drawn from stope chutes		769.2
Tons of ore handled per shift		28.5
Tons of ore handled per man shift		14.2
Cost per ton of ore handled by scraper		34.2c

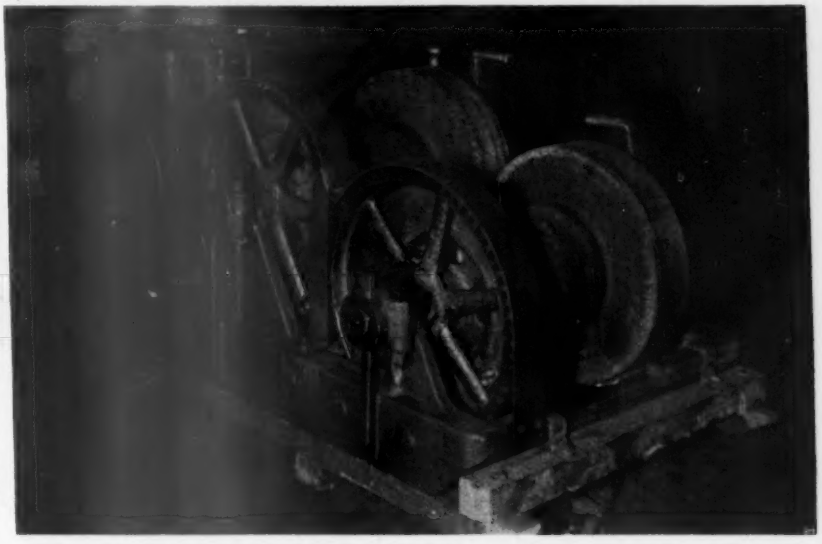
The third period of this test gave the following results:

LABOR:

Hoistman:	32 shifts @ $5.75	$184.00
Miner:	32 shifts @ 5.45	174.40
Total		$358.40
Deductions due to delays:		
1 shift 2 men repairing manway	$11.20	
1½ shift 2 men repairing hoist	16.80	
1½ shift 2 men moving hoist	16.80	
Total	$44.80	44.80
Actual charge against scraper		$313.60
Total cars of ore drawn from stope		811
Capacity per car		1.2 tons
Total tons of ore drawn from stope		973.2
Tons of ore handled per shift		30.4
Tons of ore handled per man shift		15.2
Cost per ton of ore handled by scraper: 32.2c which cost includes plugging and mucking.		

In these tests, the costs were obtained at the sacrifice of capacity, as the work only indicates a capacity of approximately 30 percent of what may be obtained by hand work. The destruction of flooring, repairs to equipment, and admixture of waste are additional factors that tend to explode the theory of scraping in horizontal cut and fill stopes, especially in stopes requiring numerous bulkheads.

In any case where ore breaks fine enough to be handled by a 5 to 8-cu. ft. scraper operated by a small hoist that can be easily transported from one place to another, I believe scraping will be successful. Wherever scraping operations can be carried on on a rock bottom, or where steel rails may be laid for the scraper to operate on, and a supply of ore delivered down the slope to the bottom of the scraper, the operation will also prove satisfactory.



Goodman double-drum 35 H. P. drag line hoist used in some of the experimental scraping tests at the United Verde Mine

V

Scraping sill floors in horizontal cut and fill stopes.

Type of hoist—Double-drum, 7½ H. P. with 3/8-in. rope.

Type of scraper—Box type scraper with extra weight and capacity of 4 cu. ft.

Operation—Hoist in one position, head block pinned to wall.

COSTS

	Scraper	Hand
Labor, Air, Plugging, Explosives	25c per ton	37c per ton
Depreciation	4c per ton	
Flooring		5c per ton
Total	29c per ton	42c per ton

This is the only class of work showing a profit that would justify the method over hand work.

VI

Scraping in long drifts with incline to cars.

Numerous experiments of this kind were carried out, but in every case costs, if depreciation and equipment were included, were greater than hand work.

CONCLUSIONS

Shoveling Machines: We do not consider it practicable, with present types of shovels, to economically shovel in narrow drifts. With shovels of durable and compact design, and in drifts 7 x 7 ft. and larger, there should undoubtedly be a field for mechanical shovels, depending on rate of pay and supply of labor, and speed required in driving.

For horizontal cut and fill work, under our conditions of shovelling off flooring laid on waste fill and with coarse, heavy sulphide ore, there is no economy over hand work under present labor conditions. It would appear more logical to adopt methods of mining that would eliminate mucking if possible.

For spreading waste in horizontal cut and fill stopes, the cost under our present methods amounts to approximately 7c per ton of ore extracted, and the margin of profit to be gained by either shovel or scraper work would not justify equipment installation.

Scraping: Under certain special conditions, considering character of material, mining method, labor market and wage scale, scrapers should be adaptable, and when this possibility exists careful experimental work is justified.

Despite the failure of scrapers and mechanical shovels for all classes of work, we are still optimistic regarding mechanical loading at the United Verde. However, we can see no reason why such equipment should be a cure-all for every class of work and are inclined to the idea of adapting mechanical loading to these special conditions where it is satisfactory and then, by gradually changing conditions of mining, to expand this field in anticipation of a poor labor market when it is impractical to change the mining method so that hand work may be eliminated.

Investigation work in ceramics by the Bureaus of Standards and Mines is being centralized in the Bureau of Standards, under direction of P. H. Bates. To bring those interested in production of ceramic materials into closer relation with the Department of Commerce and to develop more extensive effort and cooperation, a meeting will be held March 4, of representatives of associations to form an advisory committee to the department.

MECHANICAL LOADING UNDERGROUND AT THE BENNETT MINE

Experiments Carried On Over A Period Of Several Years Have Resulted In Fairly Well Standardized Equipment At The Bennett Mine—Mechanical Loaders Have Increased The Output And Simplified Their Labor Troubles

By A. E. SCHNEIDER *

IN APPROACHING this subject, the problems at the Bennett mine only will have consideration, as the varying conditions in Mesaba Range mines are such that each mine is a problem in itself and mechanical loading, in any one of its numerous methods, ought to be determined on the physical conditions inherent in each mine.

Underground mechanical loading may be said to have revolutionized underground mining in operating methods, production per miner and effort expended by the men. In the final analysis, probably the last point should be mentioned first and given emphasis, as operators on this range and also other districts, have for years been giving the welfare of the miners serious and sympathetic consideration.

Our underground operations tributary to No. 1 shaft had been planned for hand loading into cars and the entry drifts were driven on 50-foot centers. In actual mining, the miners would drive their slices four to five sets on each side of the entry drift. In this operation we were able to carry two slices at the same time, in one of which a track was laid to keep the tram car close to the muck pile. Under these conditions we were able to obtain better production figures by hand loading methods than some mines were getting with machine loading at that time, which caused us to hesitate in mechanizing our mine. At this time experiments in mechanical loading did not involve loading into sub-level cars, but for the most part were planned to pull the ore directly into raises or chutes, which did not require any further handling of the ore on the part of the miners.

These conditions did not hold at the Bennett mine, as the working places were all from 100 feet to 600 feet to the nearest chute, and the fact faced us that regardless of the method in which the ore was put into the sub-level car, a long hand tram was still required to get the loaded car to the chute.

At this point it might be well to mention that our underground ore body has area instead of depth and its thickness permits winning the ore on two sub-levels. The ore dips to the south and east at an angle of eight to ten degrees, the width being 800 feet to 1,000 feet from the open pit on the north to the property line on the south side. Reference is thus briefly made to the character of the formation to show that it would be impracticable and too expensive to put in a series of main haulage drifts to permit slushing directly into chutes or raises.

Several years ago we determined to experiment with mechanical loading, in line with similar work by other operators, and we purchased five single drum air machines using the ordinary slip scraper. The men did not take kindly to this method of loading, complaining about the effort required to drag the empty scraper from the car to the muck pile. We gave this objection considerable weight as it was obvious that a loading device that did not reduce the effort expended by the miner could not be considered a success.

With this objection in mind and also considering the fact that the single drum machines did not appreciably increase the product per miner, we decided to try out the double drum type slushing machine with the bottomless scraper, using compressed air for power.

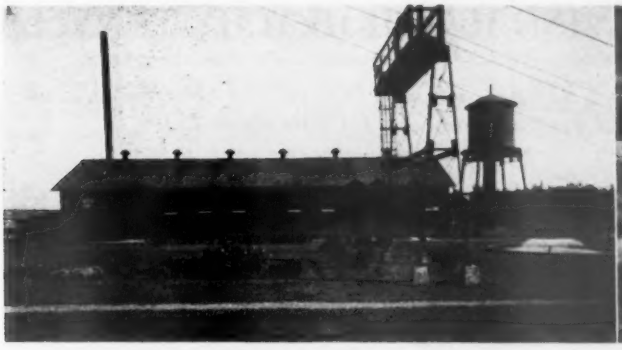
As soon as we started using the double drum machine our product per miner showed a decided increase over the single drum type and we decided to standardize our underground mechanical loading with the double drum machine.

During this experimental period, we were developing the ore that would be made available by a shaft known as No. 2 and the results of our work along this line caused us to make some changes in development of this new area in order to take advantage of our natural conditions. With this thought in mind, we determined to drive our entry drifts on 100-foot centers which at that time was a decided departure from the customary underground development. This decision saved us a large sum of money in raising in rock from the main level to the sub level and also in reducing by exactly one-half the ore drifting required in order to develop the ore body. The idea behind this decision was to make our slices longer so that the amount of ore would be increased for each setting of the machine.

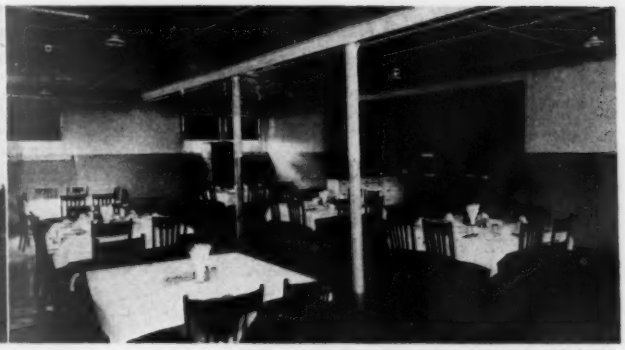
As referred to above, all the ore in the Bennett mine must first be loaded

Typical setting of double-drum machine for underground mechanical loading at Bennett mine, showing slide, open bottom scraper and machine mounted on platform

* Superintendent, Bennett Mining Co., operated by Pickands, Mather & Co.



Change house at Bennett mine



Dining room provided for employes

into a car for tramming to the chute and this involves the ore being pulled over an incline. We found it advantageous in the efficiency of the machine and also the safety of the miners themselves to have the double drum machine mounted on a platform about a foot above the top of the car so that the operator of the machine could have clear view of the full length of the slice.

We have endeavored as far as possible to standardize all our slices and likewise the placing of machines and slides. In starting a room, the open sets are placed in the drift, provision being made for two slices. The slide and machine are placed in the drift the required distance, which is about 50 feet outside of the old caved room and all the open set ore is loaded with the machine from this setting. At this time also four additional sets of ground are removed, one on each side of the open sets and after this has been done and the timber put in place, the room is ready for the standard slicing operation.

These four additional sets are taken out at this time to provide for the slide and also for machine platform. The slide is built on one side of the open set, next to the old cave and the platform is built on the opposite side of the open set for the machine, as shown in the accompanying photograph. The room is now ready for slicing and the first set of ground on the side of the room in which the slide is built is blasted on top of the slide.

A telescoping boom made of two pieces of pipe, one to slide inside the other is placed in the back, one end against the cap and the other end in the pillar, a pin being inserted through the pipes after being tightly adjusted. On the end of the boom next to the breast a clevis is attached on which a snatch block is suspended and through which the tail rope passes. When the ore blasted has been loaded, another set of timber is put in and this operation is then repeated for a distance of approximately 50 feet from the entry drift. This completes one slice and the machine and slide are then moved in position for taking out the next slice. At times we have been able to carry two slices open at the same time, but in doing this a certain amount of ore is thrown into the slice remaining open and this amounts to a considerable quantity by the time the second slice has been driven in a distance equal to the first slice. The volume of ore was found to be such that after cleaning up the second slice it was necessary to move the machine back to pick up the loose ore thrown into the first slice. We later determined to blast down the first slice after its completion, the additional expense in boarding up this single slice offsetting the work of picking up the loose ore thrown into it when left open. In blasting down this first slice, we build our breasting at the first set from the entry drift doing the same thing when blasting down the second slice. One side of the room then being completed, the positions of the slide and also the machine platform are reversed and slicing is then carried on to take out the opposite side of the room.

It so happens that the bottom contours of the ore body are more or less irregular and stoping up the room below the entry drift is required in some instances for a depth of from one to three feet. We have found that the required stoping can be done with hardly any loss in efficiency if the height of the ore above the entry drift is sufficient to give ample head room.

As the conditions underground so shaped themselves and additional air power machines were put into service, we realized that our compressor capacity would limit the number of machines for mining. We tried out a double-drum electric machine with a 220-volt direct current motor, 6½ H. P. This machine was very carefully observed and was used under varying conditions in the mine. A voltmeter was included in this installation and we were very agreeably surprised to learn after an extended test that the electric machine was much more satisfactory in every respect, both for operating upkeep, power consumption and power for loading. We found with the electric machine there was a certainty of full and steady power against fluctuating power when air is utilized and in addition, the operation of the electric machine is much quieter. From the safety standpoint alone the electric machine appeals to us very strongly, as it permits the men to judge conditions much better in a room that is heavy. To keep an air machine at its maximum efficiency, it must be in first-class condition and this requires frequent inspection and sometimes major repairs.

The comparison of the air machine with the electric machine having proved various points in favor of the latter, we gradually added to our underground loading equipment so that at present about 60 percent of our places are equipped with the electric machines.

Other mines have shown excellent results by the use of single-drum machines and there is no intent in this article to give the impression that a mistake is being made when using single-drum machines. Conditions are so variable on the Mesaba Range that it is practically impossible to take any plan that has been worked out at one mine and move it bodily into another. Great credit is due operators who have shown good results with the single-drum machine, but we feel that even though equal results are obtained by either type, that if it is possible to use a double-drum machine it certainly ought to be installed if for no other reason than that it is easier on the miner and he is fresher for doing other work such as timbering and drilling if the mucking operation is completed with a minimum of physical effort.

We offer an annual prize to the residents of the Bennett location for best appearing lawns and gardens and it so happened that for the season of 1925 one of our underground miners was awarded the first prize for his lawn and flowers and the second prize for his garden. In extending the money prize to him, which was two 10-dollar gold pieces, I mentioned to this miner that we certainly appreciated the effort he had shown in (*Continued on page* 209)

MECHANICAL LOADERS IN DRIVING HETCH HETCHY TUNNELS

Mucking Machines Preferred To Hand Mucking Where Rapid Progress Is Desired—In Selecting A Loader Dependability First Consideration, Speed Second, And Cost Of Operation Third

By N. A. ECKART *

THE tunnel work covered in the scope of this paper is some 20 miles of tunnel, driven by the city of San Francisco in the Sierra Mountains, forming what is generally known as the Mountain Division of the Hetch Hetchy Project, which has for its object the delivery of some 400,000,000 gallons of water from the upper reaches of the Tuolumne River and its tributaries to San Francisco, and provides incidentally for the development of some 250,000 horsepower.

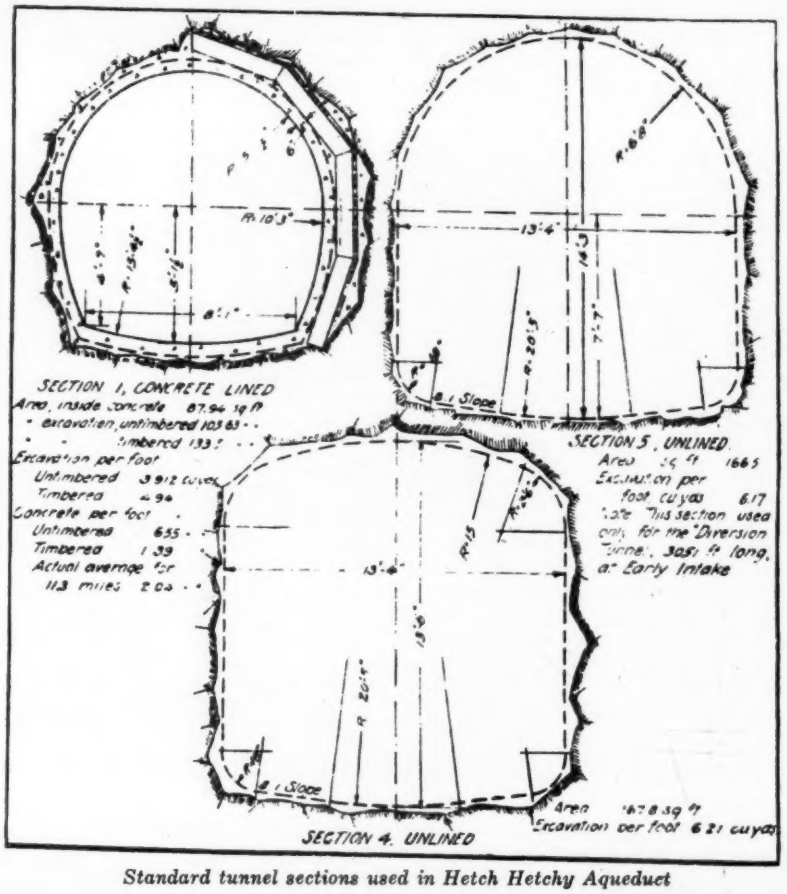
Armstrong shoveling machine and cars at east portal of Pulgas tunnel

Commencing at Early Intake, the point of diversion on the Tuolumne River, 156 miles east of San Francisco, elevation 2,326 feet, the tunnel has a continuous grade of 1.55 feet per thousand for 18.8 miles to the Priest Reservoir, from which reservoir another piece of tunnel, known as the Moccasin Power Tunnel, extends a little over a mile to a surge chamber, which serves as a manifold for the penstock for the Moccasin Power Plant. The grade of this tunnel is 6 feet per thousand.

The upper 7½ miles of tunnel from Early Intake to a point between adits 8-9 and 5-6 is in granite, and is unlined, except for a few short stretches. The tunnel section used generally in this portion of the work was what is known as section No. 4 (see diagram), which is 13 feet 4 inches in width and 13 feet 6 inches in height, with a very flat arched roof. In sections where the ground conditions indicated the desirability the section was modified to a circular arched roof, similar to section 5, which was used for the first half mile. Before it was determined to omit the concrete lining in this upper portion of the tunnel quite a length was driven to the Standard No. 1 section, or a modification thereof, which was afterward enlarged to Section 4.

The lower 11.3 miles of the long tunnel is through diorite, quartzite, slate, and amphibolite schist, and is lined throughout with concrete, having a minimum thickness of 6 inches. Tunnel Section No. 1 was used practically throughout this entire length, aside from a short distance near the Priest portal. Very little of the tunnel required timbering. This tunnel section is of horseshoe shape, the neat line of excavation being 11 feet 3 inches in height and width, with full circular arched roof and the walls curved in, giving a width of approximately 9 feet at the floor line.

The Moccasin Power Tunnel, from its east portal to the surge chamber, is of a horseshoe section, 13 feet in diameter, concrete lined, with 9 inches minimum



Standard tunnel sections used in Hetch Hetchy Aqueduct

*Chief Assistant Engineer, Hetch Hetchy project.

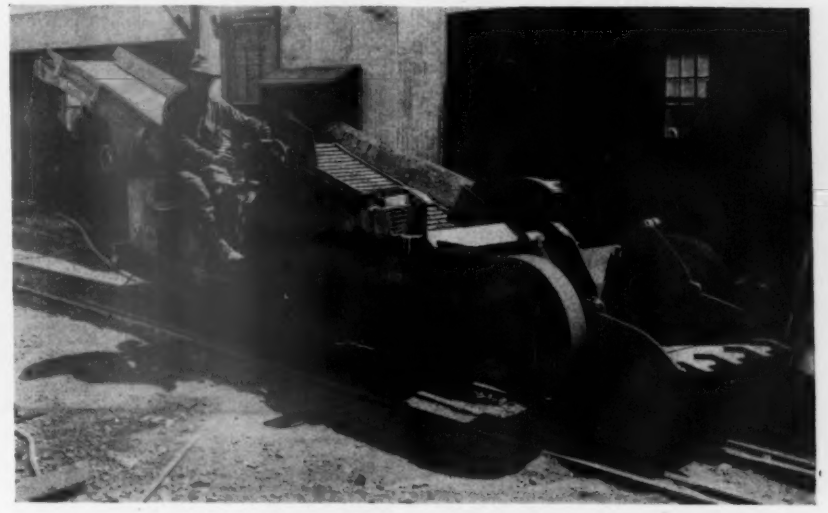
thickness. In the portion requiring timbering (1,637 linear feet), the excavated section was 16½ feet. West of the surge chamber are three smaller parallel tunnels, each 13 feet square, timbered throughout, in which 104-inch steel pipes have been laid and concreted in.

The tunnel from Early Intake to Priest was driven from 14 faces, and the Moccasin Power Tunnel from both ends. The distance between working points and the distance driven from each point is shown in the following table:

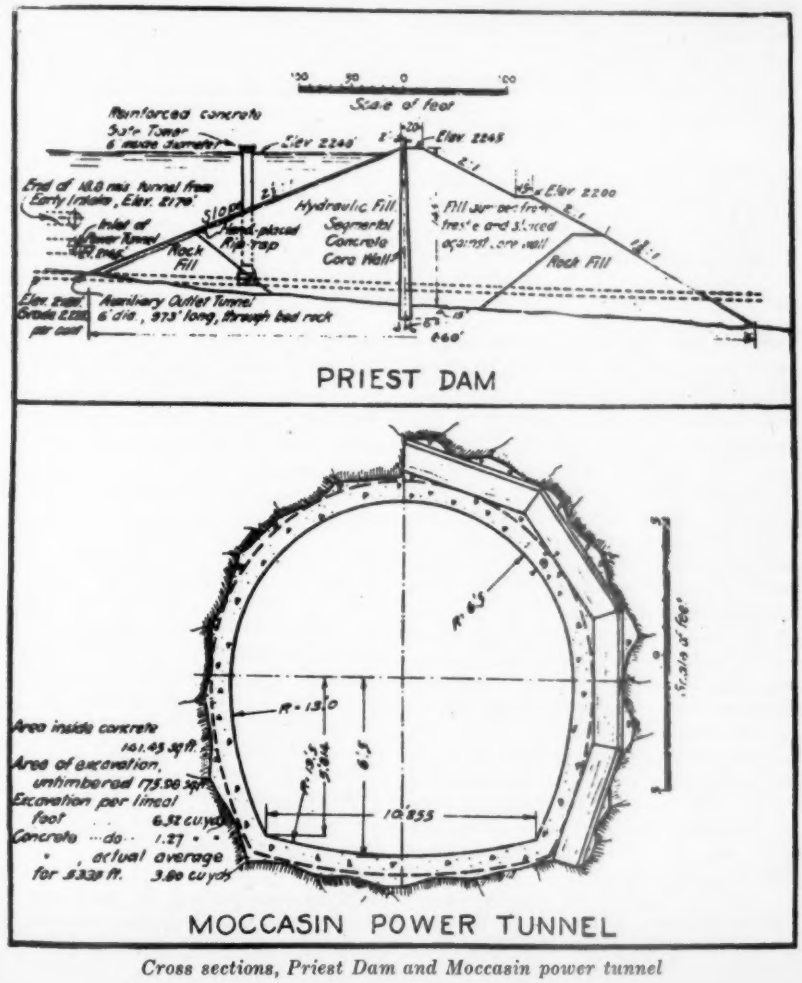
	Tunnel driven East	West
East Portal Diversion Tunnel....	.....	201
Intake adit (original portal).....	2,842	11,632
South Fork	12,059	5,599
Adit 5-6	4,257	7,435
Adit 8-9	7,568	4,772
Big Creek Shaft	7,700	13,136
Second Garrotte Shaft	2,180	642
Priest Portal	19,847	.....
Moccasin Tunnel, East Portal.....	.....	3,842
Moccasin Tunnel, West Portal:		
Large Section and Pipe Tunnel No. 2.....	*2,108*	.....
Pipe Tunnel No. 1.....	*549*	.....
Pipe Tunnel No. 3.....	*549*	.....

From the foregoing table it will be noted that the longest drive between faces was from Intake original portal to South Fork, a distance of 23,691 feet, but that the longest drive from one face was from Priest Portal, where 19,847 feet was driven toward Garrotte Shaft. This was necessitated by the delay in sinking this shaft, due to excessive water encountered.

The working adits were of ample size to accommodate the blower pipes and passing track for the locomotives. The shafts were three compartment with two for hoisting, each 4 feet 6 inches by 4 feet 6 inches, and a manway 4 feet by 4 feet 6 inches. Between South Fork and 8-9, where the tunnel followed along the canyon of the South Fork, there were several intermediate adits which were used for dumping purposes only.



Myers-Whaley mucking machine



Cross sections, Priest Dam and Moccasin power tunnel

Tunnel operations were commenced at South Fork Camp in July, 1917, and the final holing through between Big Creek and Garrotte Shaft was accomplished in November, 1923. The early work was carried on with limited forces and at few faces, due to financial limitations following the war. The maximum progress in one heading for a month was 776 feet at Priest and the maximum aggregate footage in one month (May, 1922) was 4,817 feet, while working from 10 headings.

Types of Mechanical Muckers Used

Three different types of machines were used on the work, the Myers-Whaley, the Armstrong and the Hoar. The first machine installed was a Myers-Whaley at Priest Portal in the early part of 1919, and, as with most innovations, a great deal of difficulty was experienced in overcoming the prejudice of the superintendent and men, who were without experience with mechanical muckers. This prejudice was not without a large measure of justification, as the machine was constantly breaking down and being out of commission for from two or three days to a week at a time during the month. These delays, which caused more or less disorganization of the heading crew when the machine men were called upon to hand muck, offset the advantage of the machine mucking, and doubtless would

have resulted in the abandonment of this type of machine had it not been decided to install a second machine as a spare. With a spare machine installed, it permitted removal of the machines from the heading for periodical inspection and overhauling. This permitted repairs and renewals of parts prior to actual breaking down, which always resulted in more or less consequential damage to the machine and loss of time in the shift. With a spare machine at a camp, it was rare indeed that a shift was ever lost on account of mucking machine trouble, and the cost of maintenance of the machines, a heavy item at best, was probably cut in two. The Meyers-Whaley machine became standard on the work for all headings except those driven from the shafts; 13 of these machines in all were used. A large stock of parts was carried on hand, many of them being made up on the job, this effecting a large saving, particularly in the making over and repair of the conveyor belts, which are quite an item in upkeep. Also some changes were made in the machines; notably the substitution of manganese steel in the belt chains.

The power for the operation of these machines was transmitted from a substation outside of the tunnel at 2,200 volts, 3-phase, 60-cycle current being used. The transmission cable was of the steel tape armored type without lead cover, containing three No. 10 wires. This cable was purchased in 1,000-foot lengths, which were added as the tunnel advanced. The 2,200-volt current was stepped down to 220 volts at a portable transformer station, the position of which was between 400 and 1,400 feet from the heading. Flexible cable was used to connect the 220-volt side of the transformer with the mucker, 250 feet of which was carried on the reel mounted on the mucker. As each thousand feet of advance was made, the transformers were moved ahead, and a length of 2,200-volt cable installed, which took about two hours to complete, with the splicing. Current for tunnel lights was taken from this cable by means of 1-KW transformers connected at the points of splicing.

The size of transmission cable selected was intended to serve for a distance of about 12,000 feet. After that distance was reached, it was necessary to use a set of small booster transformers to offset the line drop, and finally, when the Priest heading had been advanced 17,722 feet from the portal, the voltage drop became so great that the operation of the machine was unsatisfactory, and the last 1,837 feet was mucked by means of a Hoar air-operated machine.

The Myers-Whaley machines were too bulky to handle up and down the shafts, so that when tunnel-driving operations were commenced at Big Creek it was decided to try out the "Armstrong," a small air-operated mucking machine. The first results were quite satisfactory and three additional machines were purchased to provide a spare in each heading. This machine is one in which the bucket is swung in a fixed path directly over the top of the machine and discharged into the car behind it. Its adoption required the cars to be remodeled somewhat, cutting them down as to height and adding a lip on each end of the car so as to bring the edge closer to the mucker and prevent material being thrown between the car and the mucker. These machines gave satisfactory service while new, but after a few months' operation wear became excessive and breakdowns frequent. The design of the machine at that time was not such as to permit taking up wear in certain important members, and this, together with the poor quality of materials used in their construction (period immediately following the war), led to them being discarded in favor of the Hoar machine. In justice to the Armstrong machine, I would state that a contractor on another section of the work, at a later date, used two of these machines of a later model with reported satisfaction.

The Hoar machines were first installed at Big Creek shaft on trial in competition with the Armstrong and finally supplanted the latter on the score of dependability. These were also used from Second Garrotte Shaft until holed through to Priest, and, as before mentioned, supplanted the Myers-Whaley when the voltage drop became excessive, but were in turn supplanted by the Myers-Whaley in driving the final stretch of tunnel between Big Creek and Garrotte Shafts, when the machines could be brought in from the portals and electric power supplied from a shorter power lead through the shafts.

The tunnel footage and corresponding solid yardage mucked by hand and by the several types of mechanical muckers is shown in Table II above.

TABLE II—COMPARISON OF TUNNEL EXCAVATED BY MECHANICAL MUCKERS

	Myers-Whaley		Hoar		Armstrong		Hand Mucking	
	Lin. ft.	Cu. yds.	Lin. ft.	Cu. yds.	Lin. ft.	Cu. yds.	Lin. ft.	Cu. yds.
Intake	8,282	61,197					3,350	15,711
South Fork, East	7,018	51,302					5,040	23,638
South Fork, West	5,452	39,853						
Adit 5-6, East	4,257	30,863						
Adit 5-6, West	7,435	47,681						
Adit 8-9, East	7,568	35,426						
Adit 8-9, West	4,772	22,388						
Big Creek, East	4,961	24,584	8,956	44,778	5,927	29,635	1,200	6,000
Big Creek, West								
Garrotte, East	1,940	9,700	500	2,500				
Garrotte, West								
Priest	16,655	78,897	2,158	10,790			1,034	5,170
Moc. Po. Tun., East	3,829	29,943						
Moc. Po. Tun., West	1,475	11,534						
Outlet Tunnel	1,530	9,945						
Intake Div. Tunnel	2,829	20,935						
Totals	78,003	474,198	11,614	58,068	5,927	29,635	10,624	50,519

Note.—Above yardage is solid yards excavated—neat line plus overbreak.

TABLE III—COMPARATIVE COSTS OF MUCKING MACHINE MAINTENANCE FOR EACH CAMP—MOUNTAIN DIVISION

	Priest	Big Creek		Adit 8-9	Adit 5-6	South Fork	Intake
Period of time—Months	24	24		17	19	24	24
Formation	Slate Granite Diorite	Slates with Quartzite		Slates Quartzite Schist	Grano-dorite	Grano-dorite	Granite
Type of Mucker	Meyers-Whaley	Hoar	Arm-strong	Meyers-Whaley	Meyers-Whaley	Meyers-Whaley	Meyers-Whaley
Mucking Machine Repairs—							
Cost per cu. yd., solid yds:							
Moved, cu. yds	50,539	44,778	18,756	48,152	71,769	85,006	43,639
Material	$.567	.102	.189	.165	.247	.228	.336
Labor	$.213	.038	.075	.087	.103	.098	.146
Total cost	$.780	.140	.264	.252	.350	.326	.532

Data compiled from Monthly Cost Reports, 1921-1922.

TABLE IV

Tunnel mucked—lin. ft.				4,954
Material handled—solid—cubic yards				38,445
Material handled—loose—cubic yards				67,111
Cars loaded				25,812
Time working on muck pile—hours				4,404
Time lost due to breakage—hours				313
Maintenance in tunnel (cleaning, oiling, etc.), hours				2,486
Repairs in tunnel—mechanics' work to avoid changing machines, including time changing—hours				1,185
Repairs in shop (general overhauling)—hours				1,584
	Costs	Total	Per Ft.	Per. yd. Solid
Tunnel maintenance	Labor	$1,973.21	$.40	$.0513
Repairs in tunnel	Labor	2,118.94	.43	.0551
Repairs in shop	Labor	3,885.86	.78	.1011
Repair parts	Material	10,349.58	2.09	.2692
Total maintenance and repairs		$18,327.59	$3.70	$.4767
Mucking operation—labor		34,309.66	6.92	.8924
Total		$52,637.25	$10.62	$1.3691

View of face with loading machine, Hetch Hetchy Aqueduct

The maintenance costs of the several types of machines varied widely not only between the different types of machines, but between different camps, where similar machines were used. For example repairs on the Meyers-Whaley machines averaged over long periods, varied from 25.2 cents per yard to as high as 78 cents per yard. This exceedingly high cost occurred at Priest, where the machines used saw the longest service, and where they were working the longest distance in from the portal. This latter condition affected the cost materially, as with the low voltage toward the end of the drive, the machines would be frequently stalled, overstressing some of the parts, and again, the time and labor moving a machine in and out for repairs such a long distance is quite an element, as likewise is the cost of moving men and materials in to make repairs underground. The character of material is quite a factor in the maintenance costs. Large, blocky muck is hard on the conveyor belts. This is reflected in the relatively high costs at intake.

Table III gives the comparative costs of maintaining the several types of machines at the several camps during a two-year period.

Table IV gives data on the performance of three Meyers-Whaley machines, working between two headings at South Fork Camp, based on 11 months of operation, from October, 1921, to August, 1922, inclusive.

In the foregoing table the hours time under "maintenance" and "repairs" refers to the time the machine was being worked on and not the labor hours. The item "mucking operation" covers all labor removing the muck from the heading and disposing of it over the dump. These figures do not include field overhead and superintendence, which amounted to $1.13 per lineal foot.

The following scale of wages was in effect on the above for an eight-hour day:

Head machanic	$7.00
Electrician	7.75
Operators	6.00
Mechanics helpers	5.50
Muckers and dumpmen	4.25
Motormen	5.50

The average crew which handled all maintenance and repair work on the three machines, consisted of a head mechanic, two helpers and four operators; the electrician devoted only a small portion of his time, except when changing machines. The mucking crews were divided into two shifts in each heading. Each shift had the same organization, consisting of a muck boss, who was in charge, an operator and four men. The first shift moved the machine up after a shot and completed the major portion of the mucking; the second shift completed the mucking operation, extended the track and performed all the maintenance work on the machine in the tunnel, with the exception of oiling the drive chains, which was done by the operator on the first shift before moving up to the muck pile. The train crews consisted of three motormen in the east heading and two in the west and one dump man for each heading. It should be noted that the above costs do not include the interest and depreciation on the investment in the mucking machines and appurtenances, which would include the power cables, transformers and stock of spare parts, etc., which should be taken into consideration in comparing with the cost of hand mucking, or with other machines.

Experience on the Hetch Hetchy work indicates that the hand mucking was somewhat cheaper than the machine mucking, as far as the actual mucking operation is concerned. The advantage of the machine mucking in greater progress more than offset this difference, and the completed tunnel work, after taking into consideration overhead and interest during construction will doubtless show a marked advantage for the machines. One very great advantage of the machines is reflected in the saving in cost of securing labor on account of the high labor turnover on muckers, and the consequent reduced efficiency of the machine men who are always waiting on the mucking operation when hand mucking, which condition is naturally aggravated when the mucking crew is short-handed.

A subcontractor in the Big Creek heading, a man with a large experience in tunnel work with hand mucking methods, disgusted with the progress being made on account of a succession of breakdowns of the air muckers then in use, took them out and bought and installed an outfit of small muck cars with low sides and went to hand mucking. After 30 days trial the mucking machines were placed in service again with the explanation that "they don't breed muckers any more."

Hand mucking at South Fork for a three months' period, during which time progress of 524 feet was made, cost for labor $8 per lineal foot, this working a maximum of 12 muckers, 6 men on a shift, the usual round being 7.5 feet.

General Conclusions

The following sums up briefly some of the conclusions reached on the basis of the Hetch Hetchy experience: Mucking machines are preferred to hand mucking where rapid progress is required and the tunnel section is large enough to permit satisfactory operation of the machine. The larger the section the more important does this become; or where labor is high or seasoned muckers are scarce, provided the job is of sufficient magnitude to warrant the initial investment. A spare machine is essential to permit of proper maintenance and anticipation of repairs, which, if made before a breakdown occurs, will avoid considerable consequential damage. If the machine is of such an extremely simple or rugged type that the delays for breakdowns become minor, this would not be so necessary.

As between types of machines, dependability is the first requisite, speed the second, and the cost of operation third, then simplicity of operation and maintenance. Of course all of these are merely relative (*Continued on page* 209)

MECHANICAL LOADERS IN TUNNEL DRIVING AT BIG CREEK

The Performance Obtained From Certain Types of Mechanical Loaders In Driving The Big Creek Tunnel Is Of Special Interest To Mining Men—This Article Explains How Satisfactory Results Were Accomplished

By D. H. REDINGER*

ON THE Big Creek hydro-electric development which the Southern California Edison Co. is carrying out, and has been for a number of years, one of the major factors of construction is that of tunnels, of which the two principal ones constructed to date are those known as Tunnel No. 3 and the Florence Lake Tunnel, the length of the former being 6 miles and that of the latter 13½ miles. The theoretical section of the former is 21 feet by 21 feet, while the latter is 15 by 15, but with the overbreakage in both tunnels the completed section is approximately a foot larger in both cases.

One of the most important, if not the most important, items in driving a tunnel is that of mucking because progress depends upon the time it takes to clear the muck after blasting a round so as to allow the operation of drilling to be resumed. Time was the principal element in regard to the completion dates of both of these tunnels, all of which was made necessary, of course, on account of the demand for power in southern California.

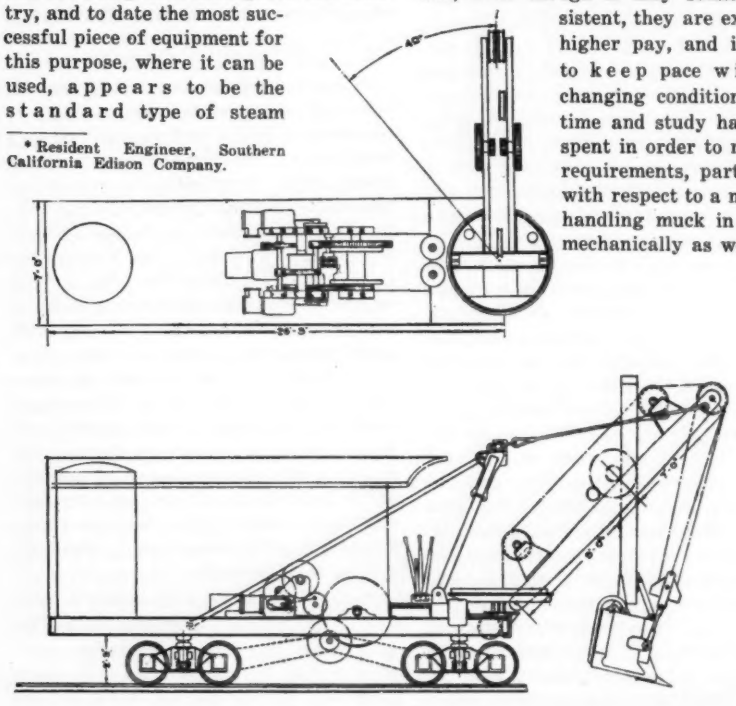
For the removal of muck from tunnels the same thing holds true as is the case with mining, namely, that various kinds of mechanical devices have been tried out and are being used throughout the country, and to date the most successful piece of equipment for this purpose, where it can be used, appears to be the standard type of steam shovel, operated with compressed air or electrically. The workmen of today are

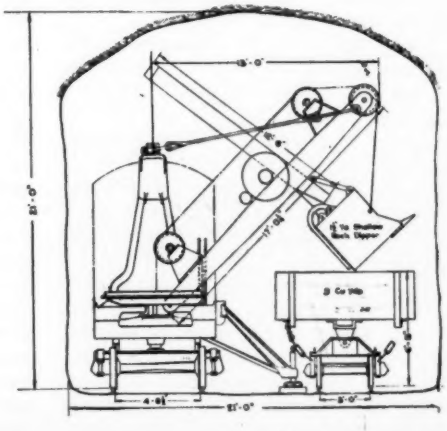
D. H. Redinger

looking for jobs requiring decreased physical effort, shorter working hours, and, even though it may sound inconsistent, they are expecting higher pay, and in order to keep pace with the changing conditions much time and study have been spent in order to meet the requirements, particularly with respect to a means of handling muck in tunnels mechanically as well as in mines. A scarcity of labor has also been a large factor in this situation, and, on account of this, it is necessary to do something that will tend to keep the labor turnover at a minimum. There has been a remarkable improvement in conditions affecting the workingman on the average construction job in all phases during the last 10 or 15 years.

In a tunnel of the section as that applying to our Tunnel No. 3 it was possible for us to use a standard size shovel, and for this purpose use was made of several Marion models 20 and 40, making only such modifications as were necessary in the boom and dipper stick to adapt them to this section. In the accompanying sketch it will be noted the boom was cut to length of 16 feet and dipper stick to 11 feet. The average mucking time in Tunnel No. 3 was nine and three-fourths hours for a round averaging between 13 and 14 feet. One of the main advantages of such equipment is its rugged construction, allowing it to withstand all kinds of hard usage necessary for this kind of work, and particularly in tunnels such as these, which go through hard granite. Very little soft ground was encountered in Tunnel No. 3, and to be exact the amount was only 1 percent of the total length of the tunnel, while in the Florence Lake Tunnel the soft ground encountered was about -- percent of the total length.

In all confined heavy loading work, such as was the case in the tunnels being described, and where the working room is limited, it is necessary to keep the shovel and loading tracks closely alongside each other and both headed directly into the muck pile to be removed. The most

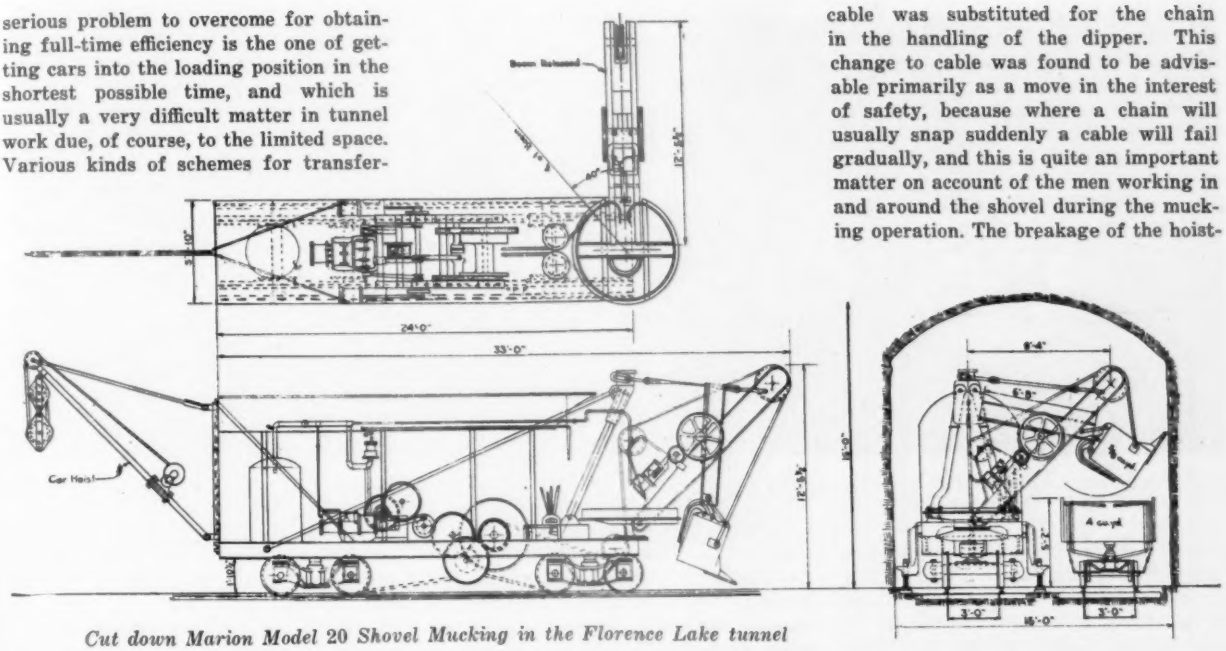




Marion Model 20 Shovel as used in tunnel three

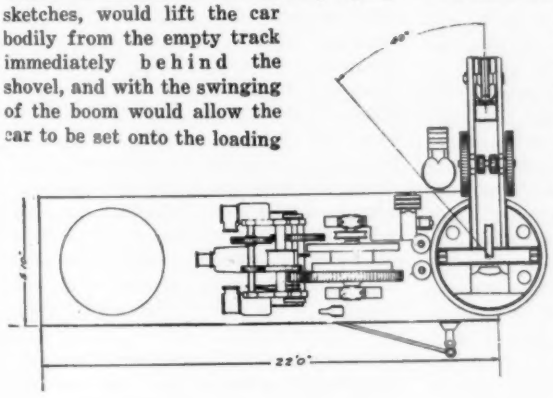
* Resident Engineer, Southern California Edison Company.

serious problem to overcome for obtaining full-time efficiency is the one of getting cars into the loading position in the shortest possible time, and which is usually a very difficult matter in tunnel work due, of course, to the limited space. Various kinds of schemes for transferring cars from one position to the other have been used in the way of switches and lifting devices, but the desire is always paramount to get something still more satisfactory. In the use of our standard size shovels we found it better to make use of a boom and hoist mounted on the rear end of the frame for the handling of empty cars from the empty to the loading track. This mechanism, which is shown in the accompanying sketches, would lift the car bodily from the empty track immediately behind the shovel, and with the swinging of the boom would allow the car to be set onto the loading track alongside the shovel with the least time lost and with a corresponding minimum switching expense, all the while keeping this particular operation close to the muck pile. The principal part of this lifting device was a Little Tugger hoist, which received its air from the same source as the shovel and all the operations were handled by the pit crew.



Cut down Marion Model 20 Shovel Mucking in the Florence Lake tunnel

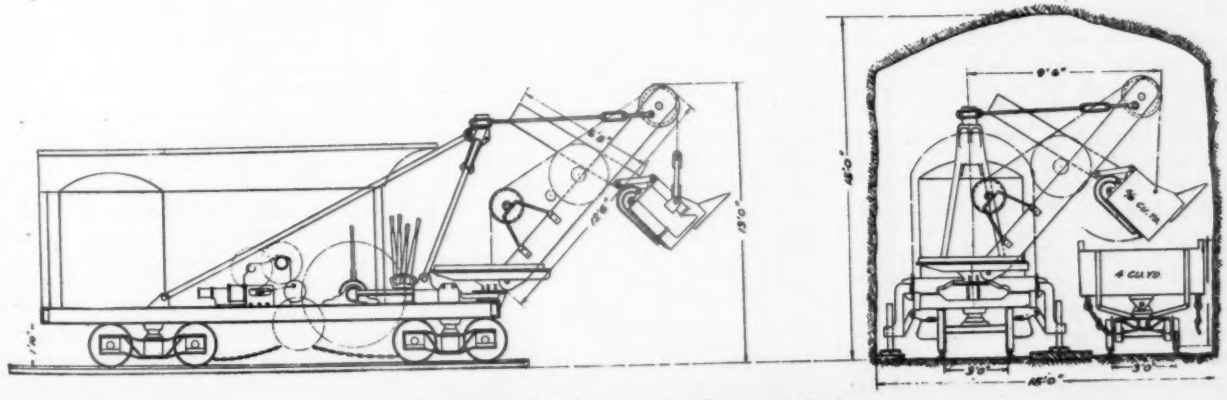
Even though the section of the Florence Lake Tunnel is several feet smaller than that of our Tunnel No. 3, we found it possible to use our Marion 20 shovels, after Tunnel No. 3 was completed, in the Florence Lake Tunnel by cutting down the main frame, including gauge from standard to 36 inch, and making further alterations to the length of the boom and dipper stick, as shown in the accompanying sketch, and in this general cut-over scheme cable was substituted for the chain in the handling of the dipper. This change to cable was found to be advisable primarily as a move in the interest of safety, because where a chain will usually snap suddenly a cable will fail gradually, and this is quite an important matter on account of the men working in and around the shovel during the mucking operation. The breakage of the hoisting lines is an important matter also on account of delays. As a result of working in such close quarters, it is necessary to reduce all sheaves, drums, etc., to a minimum diameter, and such reduction, of course, will tend to increase cable breakage.



Before we cut over and moved any of our Marion 20 shovels into the Florence Lake Tunnel we had been using two Marion shovels, model 25, which were made for us by the Marion Steam Shovel Co. expressly for use in that tunnel, and while these shovels did very good work, we derived better results from our cut-over Marion 20's, due to the heavier weight, heavier parts, and being more rugged in general throughout.

The average time under normal conditions for mucking out an 11-foot round in this tunnel was 3 hours and 50 minutes.

In the accompanying picture one of the Marion 20's is shown in action in the section of the Florence Lake Tunnel between Camps 62 and 63 making the



Marion Model 25 Shovel as used in Florence Lake tunnel

Muck train, showing combination battery,trolley type locomotive and loaded cars

Dining car train in Florence Lake tunnel showing crew enjoying its mid-shift meal

final cleanup at the point of connection between these two camps. This picture gives a very good idea of the location of the shovel with respect to the car as they worked under normal conditions throughout the construction of this particular tunnel. All of the shovels used in Tunnel No. 3 and the Florence Lake Tunnel were equipped with railroad type of tracks. Consideration at one time was given to the replacement of this type of track with a caterpillar tread in order to allow much more ease in movement of the shovel at the heading, as there is quite a bit of work involved in laying sections of track for the track type of shovel. After a great deal of study had been given to such a replacement, the idea was abandoned on account of various complications; but there is no doubt that were new equipment to be purchased at this time for similar work several advantages could be gained by having such equipment provided with crawler track.

The size of the muck to be handled by any kind of equipment plays a very important part in the operation of same and in the speed to be obtained. It is, of course, apparent that in all cases where rock is broken to a size, a large part of which can not be handled by the shovel, a large amount of delay is caused on account of the large pieces having to be broken up, and which usually has to be done by drilling and blasting or sledging. It should be pointed out that the drilling and blasting of large pieces of rock which have been removed from the muck pile is a precarious procedure, due to the danger of drilling into a missed hole that may have been responsible for the rock to break so large, and it is always preferable to lift such a piece in full size as originally blasted, if it can be handled at all. In many cases it is necessary to move such rocks by the use of chains, lifting them to the height of a flat car, on which they are sent outside instead of in a dump car. Another advantage of a standard size steam shovel in mucking is its ability to work as well with water in the pit as when working in the dry, and this is not true of all other types of mucking equipment. Even though it may be possible to handle a piece of rock all of which can not be taken into the dipper, trouble is encountered if the piece overhangs, causing it to scrape along the tunnel wall and requiring considerable skill on the part of the operator to get it into the car.

The weight of mucking equipment is very important because blasted rock when piled up under conditions as are common in tunnel work usually has the larger pieces wedged in the pile so as to require heavy pulling efforts to release. For this reason some of the lighter shovels or mucking machines cause trouble to a large extent by being lifted off the track at the rear when the dipper is being loaded or is exerting a heavy pull on a large piece of rock. Unless the material is blasted to a small size there is bound to be a large amount of breakage of parts on the crowding, hoisting, or swinging mechanism, with consequent delays, and such breakage may become so serious as to discourage the use of any lighter equipment than can be worked with good loading efficiency. A conveyor belt has possibilities in underground work where there is enough track room to permit running two tracks alongside each other—one for the loader and the other for the cars, allowing an arrangement by which it would be possible to convey the material to a chute or hopper, which again delivers crosswise to the cars, allowing a steady string of cars to be loaded without doing any switching other than that required to bring in empties and take out the loads.

Our motive power in both tunnels consisted mostly of 8-ton Baldwin-Westinghouse locomotives, combination battery and trolley type, one of which is shown in the accompanying picture, taking a muck train out of the Florence Lake Tunnel at Camp 62. The combination locomotives were used so as to have the use of a battery when going beyond the trolley wire, as was always the case near the heading, since it is not possible to carry the trolley wire any nearer a heading than will insure its safety from blasting, and most all of our hauls were too long for the ordinary battery to withstand without being charged too frequently. The cars used in Tunnel No. 3 were of 10-yard capacity, 36-in. gauge, and of the side-dump type. This particular tunnel was equipped in the beginning with tracks made of 35-pound rail, but we soon found that we could secure much better service by using 50-pound rail instead, and which was also true with respect to the Florence Lake Tunnel. The cars in the Florence Lake Tunnel had to be smaller than those used in Tunnel No. 3 and had a capacity of 4 yards, but being, of course, of the side-dump type and 36-in. gauge.

Aside from mucking equipment, operations, etc., a very important matter where headings are so far underground, as was the case in our Florence Lake Tunnel, is that of the feeding of the men. When an hour and a half in time is required to take a crew from a heading to the mess hall, allow the men time enough to eat and return them to the heading, it can readily be seen how important this is, and to overcome which we arranged for dining-car trains to be operated, and which served the midshift meal to the crews in all headings where such service was required. In the accompanying picture is shown one of the shifts of men eating on one of these trains in the Florence Lake Tunnel. Such a setup was

Marion Model 20 Shovel Mucking in the Florence Lake Tunnel

enthusiastically received by all of the men, particularly in the winter time, as it was not necessary for them to go out into the cold until the end of the shift, when they could go directly to their respective bunkhouses.

At the present time we are driving a tunnel about 5 miles long between Huntington and Shaver Lakes, and since the section—13 feet by 13 feet—is too small to allow the use of any of our former standard shovel equipment, we are making use of the Conweigh loader. In our few weeks' experience the results with this machine have been quite satisfactory with respect to the mucking principle, which appears to be better than that in anything else we have used for this size of tunnel. One of the main advantages of this type of mucking machine is its ability to make a quick cleanup of the shattered rock along the track and tunnel floor immediately after a blast and before the loader reaches the main part of the muck pile. With the use of a standard steam shovel most all of such cleanup has to be made by hand because the corners can not be reached with the dipper. This is not true of the Conway, whose performance in this respect is wonderful.

There are various types of good mucking machines, as far as their capacities, method of operation, etc., are concerned, but in the final analysis the cost of upkeep based on progress is the answer.

LOADING AT BENNETT MINE

(*Continued from page* 201)

making his promises attractive and that this effort had been reflected in the appearance of the premises of his neighbors. I also remarked that he evidently took gheat pleasure in having a nice, neat looking place and he answered me in about these words:

"You see, my wife and I like to have a nice place. I have worked in mines for a good many years and when I first started mining we had nothing else to handle the ore with but a shovel and when I came out of the mine and got home, I figured I was entitled to some rest and I would sit down after supper and read for awhile and then go to bed, but now it is different. We use machines to put the ore in the car and a man comes out of the mine pretty fresh and when he gets home he feels like doing something. He will go out in the yard and make a place for his garden and fix up his lawn and that is the way I like to have my place."

This exemplifies better than any other means, in a concrete way, of the attitude of the miners and their appreciation of underground mechanical loading. Not only does the miner benefit, as, even though he produces more ore at a less cost per ton, he likewise earns better wages.

LOADING AT HETCH HETCHY

(*Continued from page* 205)

within certain reasonable limits, and the particular problem and conditions must be taken into consideration.

Considering the Meyers-Whaley as a type, it has the following advantages over the other types used:

Greater mucking speed by 50 percent, due to several factors—it is self propelled and cleans up full width and will load faster besides; will load into higher and larger cars, the height of discharge being 7 feet as against 54 inches; can be used to advantage in wide section up to say, 16 feet as against 10 feet; it is less dangerous to men working alongside.

Its disadvantages are: High first cost and high maintenance cost on account of both labor and parts, the initial cost being in round numbers $10,000 to $11,000 as against $3,000 to $4,000 for the Armstrong and Hoar; its size when working from a shaft; the separate maintenance of electric transmission cable and transformers, which, however, would be offset if additional air line capacity is required for the others.

No doubt considerable progress has been made in the last year or two in improving each of the several makes of machines used on this job, and others of some considerable merit have been put on the market, all of which should be investigated before selecting a machine for a new project.

STREAM POLLUTION

The grave problem of the pollution of streams by drainage of acid waters from mines is one that admits of no easy solution, according to a report just made by R. D. Leitch, associated chemical engineer, to the Director of the Bureau of Mines, Department of Commerce. The formulation of regulations governing the disposal of such waste waters is too important and far reaching in effect to permit of hasty or ill-considered action, states Mr. Leitch. A thorough study of the subject should be made in the absence of definite data bearing on the problem.

The pollution of streams by acid mine drainage has become a serious problem in the past few years in various parts of the United States. Large quantities of acids are used in and discharged from other industries than mining, notably in tube, sheet, tin-plate and enameling works. These are usually less important than coal mines as a source of acid drainage, because of their more limited distribution throughout the States most affected by acid waters and their relatively smaller numbers.

Few attempts have been made to prevent acid mine waters from entering streams. A few mines have installed some sort of equipment in which the free acid is neutralized by contact with limestone, lime, or marl. Barium chloride, or barium hydrate, has been suggested as a precipitating agent, and has been used to some extent, but so far the cost is prohibitive.

Neutralization of acid mine waters will require an expenditure of large sums of money, but it does not seem to be prohibitive in most cases to treat these wastes to overcome in a large measure present objections to their entrance into streams. Whether this will be an economically sound policy will depend upon the collection of more definite data than is now available.

Copies of Mr. Leitch's report, Serial 2725, "Stream Pollution by Acid Mine Drainage," may be obtained from the Bureau of Mines, Washington, D. C.

MECHANICAL LOADING AT THE MOFFAT TUNNEL

The Results Obtained By The Equipment Used In The Driving Of This Tunnel Are Of Special Interest To Mining Men Who Are Either Using Or Considering The Use Of Mechanical Loaders

By C. A. BETTS*

THE speed of mucking has so often been the controlling factor in tunnel and mining operations that mechanical loading devices have demanded attention commensurate with their importance. The net result has been some excellent mechanical shovels and muckers which can successfully compete with hand labor in cost and excel in speed. On the Moffat Tunnel, where 600,000 cubic yards of rock must be excavated and transported to the dumps that form the railroad approaches to the portals, the mucking equipment has received careful study, and since being installed has been developed to a high state of efficiency.

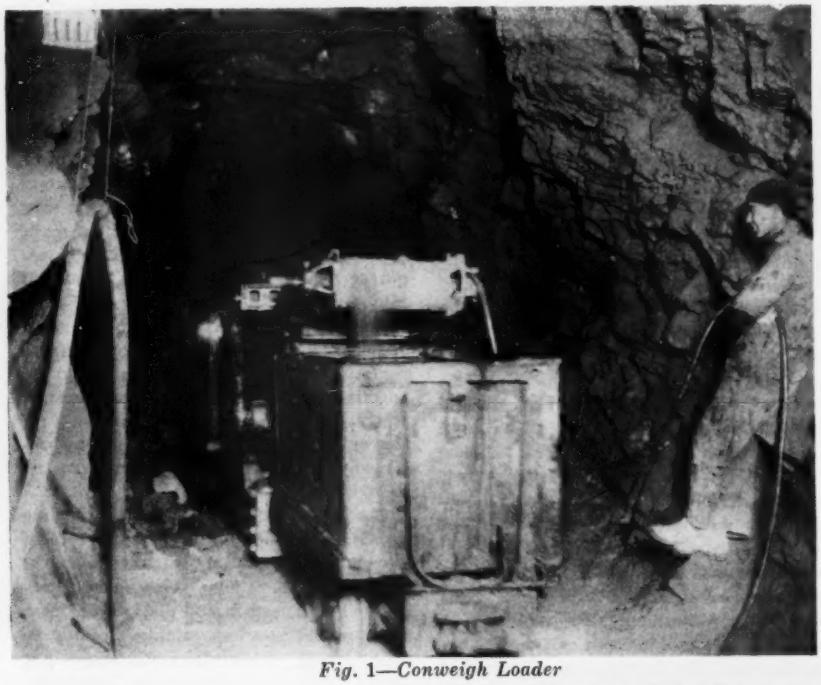


Fig. 1—Conweigh Loader

ALTERNATING SYSTEM BETWEEN TWIN HEADINGS

The conditions in the headings at the Moffat Tunnel have been unique in that the alternating system in twin headings has been successfully developed for the first time on a large scale. This is made possible by the fact that an 8 by 8-ft. water tunnel is being driven parallel with and 75 feet to the south of the 8 by 8-ft. center heading of the 16 by 24-ft. standard, single-track railroad bore. These headings are connected at approximately 1,500 foot intervals with 8 by 8-ft. crosscuts, which permit the muck and all transportation from the railroad headings, together with the ventilating pipes, high-pressure air pipes, water pipe, and wiring to be handled through the water tunnel as a service tunnel, thereby relieving the enlargement operations in the railroad tunnel from interference. In solid rock one crew can drill and shoot a round in the water tunnel heading, while the main heading is being mucked out, and can then alternate with the mucking crew and can drill and shoot the main heading before the eight-hour shift is up. In this way three crews can complete six rounds a day, which at 8 feet a round means 48 feet a day. As high as 1,583 feet have been made in a 30-day period by three shifts on the Moffat Tunnel, which is a record of which Hitchcock & Tinkler, Inc., the contractors, are proud. A drill carriage mounting four drills and running on the 24-inch track from heading to heading has been of great value in cutting the time of setting up to a minimum—about 10 minutes. Pioneer tunnels have been used both in Europe and Canada, but it remained for the Moffat Tunnel to develop the alternating system in the twin headings.

MUCKING MACHINE FOR 8 BY 8 HEADINGS

For mucking in the headings a Conweigh Loader, shown in Figure 1, manufactured by the St. Louis Power Shovel Co., has proven very effective. It was

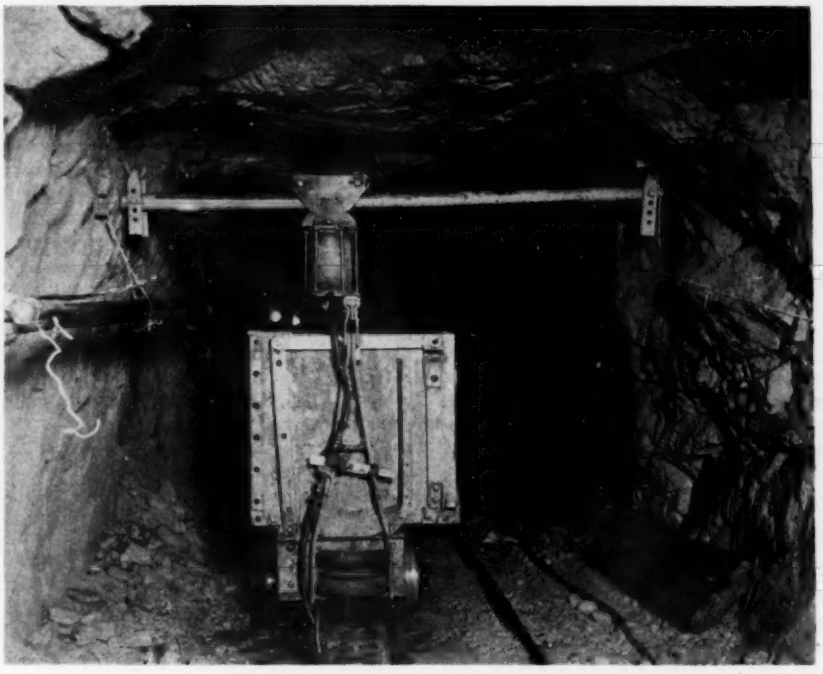


Fig. 2—Air Lift Switcher

*Moffat Tunnel Commission.

originally built for headings 8 by 12-ft. and is especially suitable for the 8 by 8-ft. headings. A heavy frame mounted with spring suspension on a 24-inch gauge truck, chain driven from a 50 horsepower trolley motor is equipped with an apron and gouging scoop that swivel from side to side in a 100 degree arc. By driving the machine ahead the scoop or digger is made to root into the muck pile until loaded, when it is lifted by chains along with the apron, which acts as a chute to feed the muck with a sliding motion down and back on to an endless rubber belt conveyor, which is continually moving and carries the muck over the rear of the machine and discharges it into the cars. The conveyor is adjustable for any type of mine car. An operator and three helpers comprise a crew and can load a two-yard muck car in about two minutes and average around 50 tons in two hours. A reel near the rear of the machine takes up the slack in a waterproof cable, which brings up the 250-volt direct current from the nearest outlet of the main 250-volt tunnel cable from the motor generator set. This machine works best in dry muck, as wet material has a tendency to collect on the belt and interferes with its operation. The machine weighs about 10 tons, and is 20 feet long by 5 feet high by 5 feet wide, which allows plenty of clearance in the average headings driven. Numerous time studies have brought out the following facts in the performance of this machine.

Costs

Careful studies have been made of the operating costs of the mucking machines and detailed records will be available at the completion of the work. During 1924 and 1925 the cost of mucking with the Conweigh Mucking Machine ranged from 75 cents to $1.95 per cubic yard, with an average near $1. This includes the labor on the machine as well as for cleaning up by hand. It also includes power, oil, and waste, but does not include drainage, trimming or repairs. The latter item averaged 35 cents per yard for labor and supplies.

Time Studies

The loading time always varies with conditions and the changeable nature of the headings at the Moffat Tunnel, with very hard grade granite one day and wet,

Fig. 3—Osgood Air Shovel

Fig. 4—Lewis Traveling Cantilever Needle Bar

soft seams the next, are reflected in the speed of operation. It is not uncommon to load a 2-yard car in one minute; it occasionally takes several minutes, and the average over a shift has been three minutes per car for loading, three minutes for switching up a new car, and two minutes for delays. Delays due to waits for cars, cleaning up fly rocks, high bottom, etc., are not included, as they may be eliminated by careful organization of the work.

Air-Lift Switcher

It is obvious from these time studies that the switching of empties up to the headings is fully as important as the actual loading time, if not more so. The customary method of a portable switch and siding with its frequent derailments and other inherent drawbacks has been supplanted on the Moffat job by a small but effective air-lift switcher, shown in Figure 2, developed and patented by Allen and O'Rourke, inspector and superintendent, at East Portal. The device picks up muck cars and shifts them laterally out of the way of the single track, returning them to the track when

needed. The hoist has an ordinary air cylinder suspended from a two-wheel trolley, which runs on a 3-inch round steel bar, supported at either end by a hook driven into the side of the tunnel. A small I-beam several inches longer than the muck car is carried under the air cylinder, and by means of steel tongs at either end grips a muck car fore and aft under the body, and by means of an operating valve on the air line raises or lowers the car several inches, which is sufficient to clear it of the track and allow it to be pushed by hand to one side.

Air Shovel in 16 by 24-Ft. Tunnel

In the enlargement to full size, which at East Portal consists of ring drilling around the center heading and shooting first the bench and then the top holes, Osgood air shovels, shown in Figure 3, have been used and have made some excellent showings. These machines, which operate by compressed air at 110 pounds pressure, were built especially for the job, with 1-yard buckets, short booms, and correspondingly low clearance. The trucks are mounted for 36-inch gauge track, so that the shovel can be readily moved out of range when the firing is done. On the rear of each shovel is a short A-frame crane with an air-cylinder hoist and tongs which can grip an empty 4-yard car that is on the track behind the shovel and transfer it to the loading track alongside, thereby eliminating the necessity for crossovers. As soon as a car is loaded, it is pulled back, either by hand or by a waiting G-E trolley locomotive, to make room for a new empty, and in this way empties are fed up on one track and loaded cars taken away on the other. The time of loading averages two minutes to five minutes with an average of 80 tons in two hours under good conditions. As many as 70,000 yards of granite have been loaded by one shovel over a period of nine months without any major repairs or overhauling which would require leaving the heading. This is a remarkable record when the rough nature of the work is considered.

Lewis Traveling Girder

In the soft ground at West Portal, which has handicapped progress for over 2 miles and has required heavy timbering throughout that distance, various methods of attack were tried out, including top heading followed by top widening and the double bench to take out the material below the wall plates. The difficulty of holding the roof timbering while two benches were taken out has been successfully overcome by the introduction of the Lewis Traveling Cantilever Needle Bar, shown in Figure 4, a device patented by George Lewis, general manager. This needle bar has successfully supported the wall plates and roof timbers tightly in place, while from 10 to 20 feet of full bench has been drilled, shot, and mucked by the air shovel and 19-foot posts set. This machine consists of two parallel 42-inch plate girders, 60 feet long, stiffly braced, 6 feet apart and running on dollies and I-beams laid flat on 12 by 12-inch timbers for track. Twelve steel arms are hung from these girders and extend out under the wall plates, so that when wedged into place they form a rigid support. After posts have been set these side arms are drawn in and the girder carrying lights, wiring, and powerful jacks is pulled ahead by an electric hoist situated on its forward end to a new position on the bench, where the process of supporting the roof timbers can be repeated. This method of excavating a full bench by air shovel is adaptable to any kind of ground now that the Lewis Needle Bar is available for soft material.

Progress

Up to January 1, 1926, the 8 feet by 8 feet water tunnel had been advanced 14,246 feet from East Portal and 11,022 feet from West Portal, or 78 percent completed. The 8 feet by 8 feet headings of the railroad tunnel were likewise 78 percent completed, and the full-sized railroad tunnel was in 11,649 feet from East Portal and 4,652 feet from West Portal, or 51 percent finished.

The Moffat Tunnel is being driven through the Continental Divide 50 miles west of Denver by a section of the state of Colorado known as the Moffat Tunnel Improvement District, created by the state legislature and consisting of territory contiguous to the Denver & Salt Lake Railroad, which will derive benefits from the operation of the tunnel. The 6.1 miles of tunnel will eliminate 30 miles of 4 percent grade over Rollins Pass, at elevation of 11,660 feet, and will make the ruling grade of the Denver & Salt Lake Railroad 2 percent. Construction of the Dotsero cutoff, 40 miles of connection between the Denver & Salt Lake and the Denver & Rio Grande Western Railroad, will reduce the distance between Denver and Salt Lake 173 miles, placing Denver on a through transcontinental transportation line. Water from the wet western slope will be brought through the tunnel to provide Denver and vicinity with the supply necessary to future growth. The entire project will cost about $10,000,000.

STORY OF DYNAMITE

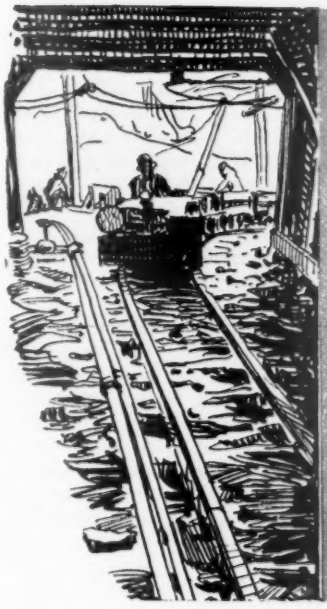
THE Story of Dynamite is the title of the latest addition to the list of educational motion-picture films distributed by the Bureau of Mines for the purpose of visualizing various phases of the mining and allied industries. The film, which was produced in cooperation with one of the larger explosive manufacturing companies, depicts vividly modern methods of the manufacture of high explosives and illustrates the importance of dynamite in the mining, industrial, and agricultural life of the country.

The mining and transportation of the natural nitrates of Chile, used so extensively in the manufacture of explosives, are shown. The manufacture of wood pulp, used as an absorbent, is depicted. The various chemical processes involved in the preparation of nitrate of ammonia, and the conversion of nitrate of soda into nitric acid are thrown upon the screen. A series of views depicts the manufacture of nitroglycerin in remote buildings surrounded for purposes of safety by wooden-cribbed barricades. The employment of careful, heat-controlled methods, in order to avoid the hazard of explosion, is emphasized. The transportation of the various explosive ingredients in rubber-lined and rubber-tired carts and their mixing under rubber-shod wheels is depicted. The processes of cartridging dynamite, the manufacture of shells, the packing of cartridges, and the making of gelatin dynamite, are shown.

Other scenes illustrate the chemical testing of the various ingredients. The testing of the strength of an explosive in the ballistic pendulum, which measures the swing of the pendulum resulting from the impact of the explosion, is shown. Another scene depicts the firing of explosives into a steel gallery to determine the possible danger of exploding accumulations of gas or coal dust such as might be encountered in mine atmospheres. The methods by which boxes of explosives are carefully packed in freight cars for shipment and the special types of motor trucks employed for their transportation in city streets are shown.

Glimpses are given of the blasting down of lump coal in a Pennsylvania coal mine. The use of high explosives in the great open-pit iron mining operations in northern Minnesota is depicted. One striking view shows a tremendous blast in a stone quarry in which 54,000 pounds of dynamite was employed to break up 190,000 tons of rock. A series of slow-motion views gives a vivid impression of the blasting of a railroad right of way. The use of gelatin dynamite in the construction of the great Moffat tunnel now being driven under the Continental Divide in Colorado is illustrated. Various scenes show strikingly the use of dynamite in the blasting of stumps, the digging of irrigation ditches, and the removal of old buildings.

Copies of this educational motion-picture film may be obtained free of charge for exhibition purposes by schools, churches, clubs, civic bodies, and other organizations by applying to the Bureau of Mines, Pittsburgh, Pa.



COAL

PRACTICAL OPERATING MEN'S DEPARTMENT

Practical Operating Problems of the Coal Mining Industry

INCREASING THE PRODUCTION OF LUMP COAL WITH ROOMS DRIVEN OFF FACE*

Relation Of Direction Room Face To That Of "Face Cleat" Should Always Receive Careful Consideration In Standardizing Drilling And Blasting Methods When Designed To Produce As Much Lump Coal As Possible—Results Of Tests Outlined

By J. E. TIFFANY †

LET us consider briefly the nature of cleats and "bedding planes" in coal beds before considering the part they play in blasting coal. The bedding planes lie parallel to the floor and roof of the bed, while the face and butt cleats are planes at right angles to the bedding planes and to each other. The face cleats occur as a succession of parallel planes, which are smoother, better defined and closer together than the butt cleats. Cleats are only vertical when the bedding planes are horizontal. Figure 1 shows these different planes which, to a certain extent, determine the sizes and approximate cubical forms of the various sized masses of coal brought down by blasting. Figure 2 shows this at the face of a room in the Pittsburgh bed after a shot was made.

The ease with which separation takes place along the three divisional planes enumerated varies in different coal beds. For example: In the Pittsburgh bed of Western Pennsylvania, the most pronounced of these planes are the face cleats, then the bedding planes and finally the butt cleats. In other coal beds, for example, the No. 6 bed of Illinois, particularly in the southern part of the state, the bedding planes become the easiest separation planes, because the cleats are poorly defined. The relative directions of these cleats to the room faces, however, affects the quantity of lump coal obtained when the coal is shot.

Fig. 1—Divisional planes in coal face and butt cleat and bedding plane

THE DIRECTION OF ROOMS

Where it is feasible the rooms are driven on the face—that is to say, at right angles to the face cleat (Figures 3 and 4) and cross entries on the butt—that is, parallel to face cleat.

It might be well to mention at this point that there may be other considerations which

* Published with approval of the Director, U. S. Bureau of Mines.

† Explosives Testing Engineer, Pittsburgh Experiment Station.

Fig. 2—Cubical form of coal after shooting a side shot

may influence the layout of the workings; among these may be mentioned the geologic structure of the coal bed within the limits of the property, together with its shape and size, and the grades of rooms or haulage headings. An increased operating cost, which arises from the accumulation of water at room faces, may generally be reduced by changing the direction in which the rooms are driven, so that they are self-draining. The question would then arise as to how the production of lump coal is affected by driving the room faces at an angle to the face cleat.

The writer, in more than one case, has been able to develop methods whereby the production of lump coal has been increased over that obtained by the methods formerly used, but has not carried out any quantitative tests in which comparison was made under the same conditions between rooms driven on the face and those driven at an angle to the face cleat. However, tests recently carried out by the Bureau of Mines in the Banning No. 2 mine of the Pittsburgh Coal Company at Whitsett, Pa., where the Pittsburgh bed is mined, have shown the relative production of lump coal from working places driven on the face and those on the butt, together with the effect of width. The quantity of 1¼-inch lump coal obtained from an 18-foot room driven on the face was 59.1 percent as compared with a 10-foot entry driven on the butt where the lump coal was 54 percent. A similar entry driven on the face produced 57.7 percent, and an 18-foot working place driven on the butt only produced 56.8 percent of lump coal. Unfortunately, the investigation did not include tests in which the room faces were at an angle to the face of the coal.

Methods Used In Shooting Coal With Room Faces And Face Cleats At An Angle

In two other investigations carried out by the Bureau of Mines, it was shown that the production of lump coal could be increased where room faces were driven at an angle to the face cleats. The first of these investigations was in a mine in Wyoming, in which the bed had a pitch of 22 degrees and was 9 feet thick. The rooms were at a slight angle to the line of strike so that the grade was in favor of the loaded cars. Figure 5 shows the face of a room where holes were being drilled, and Figure 6 the coal as shot down by the snubbing shots which were fired in holes 1 and 2 (Figure 7). This coal was loaded out before firing hole 3, which was drilled at a slight angle to the face cleats. Holes 1, 2, and 3 were parallel in order that advantage might be taken of the open end of the cleats. Hole 3 was placed so that the largest quantity of coal could be brought down with a relatively small charge. Holes 4 and 5 are fired in order that the ribs may be properly trimmed.

Figure 8 shows the method of placing holes that was used in the second of these investigations. It was carried out in a Southern Illinois mine in which the No. 6 bed of Illinois was worked with a daily production of 4,000 tons. The methods introduced increased the production of 6-inch lump coal by 2 percent. The rooms were driven at an angle of 45 degrees to the room face and their direction during the investigation was not changed. The cleats were not well defined and coal was relatively tough. The presence of a hard gray shale having a thickness of 1½ inches and known as the blue band, occurred at a uniform height above the floor of 18 inches, making it necessary to use a snubbing shot (No. 1, Figure 8).

Where the coal is of a tough nature, it becomes necessary to place the holes for the opening shots a further distance from the rib. In this case holes 1 and 2 are 3 feet away as compared with one foot for hole 1, Figure 3, and holes 1 and 2, Figure 4. It should be carefully noted that the opening shots 1 and 2, Figure 8, are on the right side of the room. Advantage is taken of the tendency of a portion of the coal to break away in the form of a wedge. There is not the same tendency on the left side of the room. On the other hand, if the room had been driven at right angles to the direction shown, then the opening shots

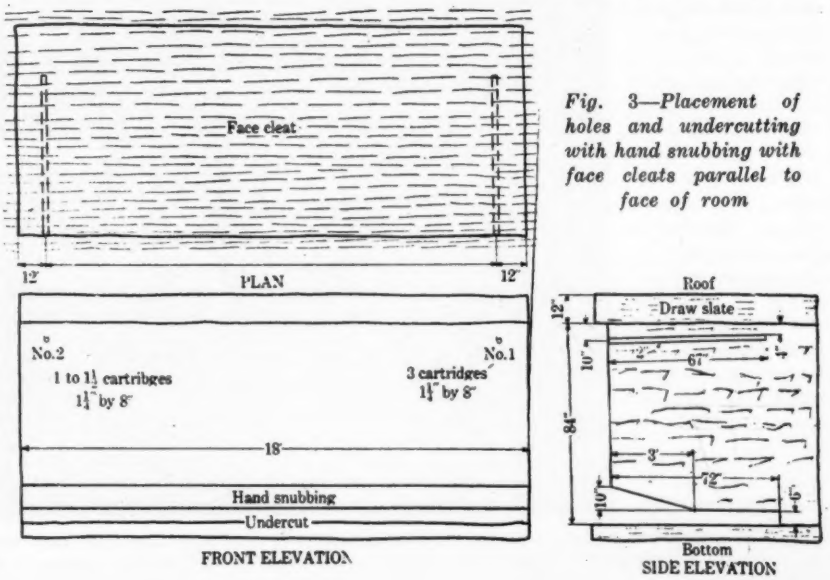


Fig. 3—Placement of holes and undercutting with hand snubbing with face cleats parallel to face of room

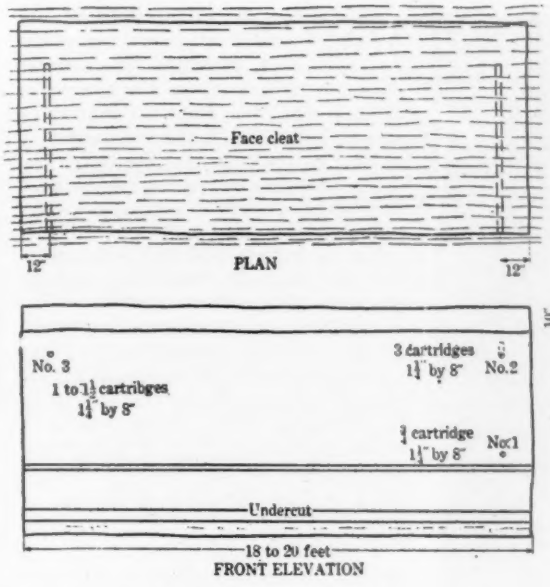


Fig. 4—Placement of holes and undercutting with snubbing shot with face cleats parallel to face of room

made there is another free face, and a third face can be obtained by shearing or by opening up shots. A middle or top cut functions in a similar manner to an undercut.

The cutting of a working place should be done in a uniform manner and the common practice of sumping in and out at an angle to the line of sights should be discouraged.

In the course of making tests it was found very advantageous to clean out the cuts thoroughly by removing all coal dust and other broken coal.

In many cases snubbing aids in the production of lump coal, particularly when the shots which are afterward fired, free the coal from the ribs and release it so that it rolls forward into the room. Figure 3 shows the manner of snubbing by hand, and Figures 4 (hole 1), 7 (holes 1 and 2), and 8 (hole 1) show how snubbing may be accomplished by snubbing shots. It will be

should be on the left side. Hole 3, in both Figures 7 and 8, produces the major part of the lump coal. Figure 8 also shows the free faces exposed by the shots. These free faces cut the face cleats at an angle. On the other hand, when the face cleats are well defined, the exposed free faces tend to conform more closely to the direction of the face cleats.

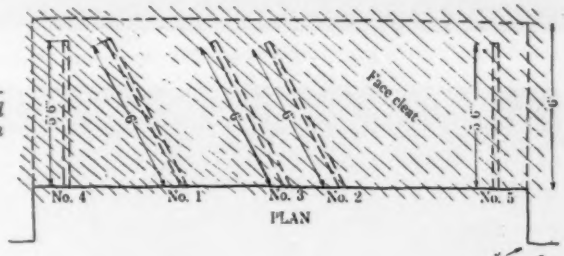


Fig. 7—(Right) Placement of holes pitching bed and face cleats at an angle to room face

General Blasting Practices

Most of the best blasting practices have been found to be applicable to a great variety of conditions regardless of the relative direction of room face and face cleat. In general, after the coal in a room has been cleaned up and before preparing the face for another round, it should be trimmed so that the corners are square, and to eliminate overhang as much as possible. As many free faces as possible should be used, because normally the face of a working place without any preparation has only one free face. After an undercut has been

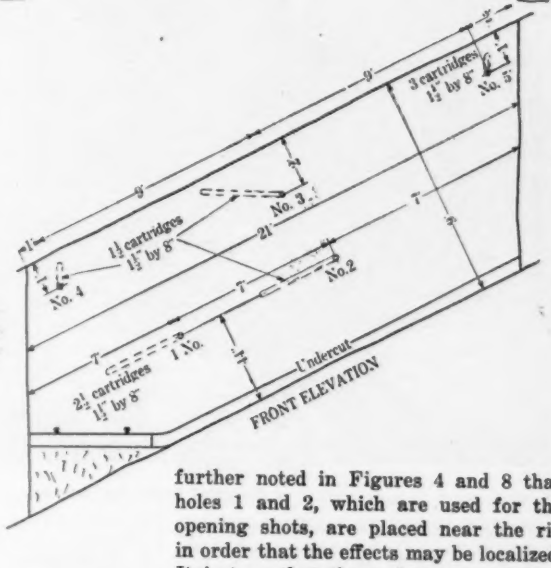
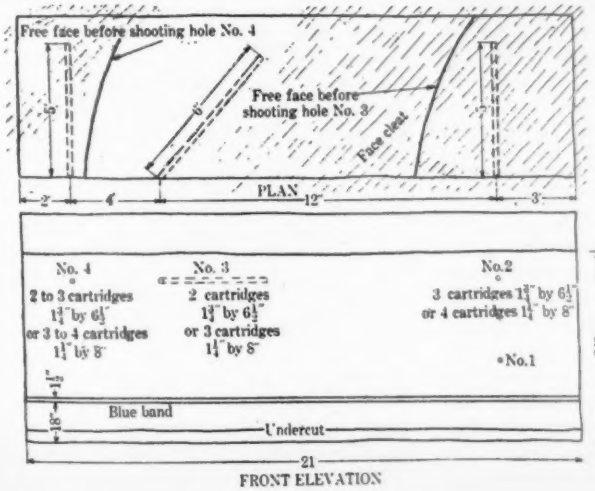


Fig. 8—(Below) A successful method of shooting rooms with face cleats at 45° to face of room



further noted in Figures 4 and 8 that holes 1 and 2, which are used for the opening shots, are placed near the rib in order that the effects may be localized. It is true that these shots may shatter the coal somewhat, but it spreads only a very short distance into the main part of the cut. Excessive charges should be avoided by increasing the number of holes, and moderate charges can be used in each hole if the explosive is properly distributed to the different holes.

The number of holes that it will be necessary to use will depend upon the physical characteristics of the coal, such as its friability and the presence, nature and thickness of bands of slate and bone,

Fig. 5—Drilling holes in room in pitching bed

Fig. 6—Coal shot down by snubbing shots

and the relative direction of the face cleat (see Figures 3, 4, 7, and 8). The conditions which are shown in Figure 3, favor the use of a hole near each rib or a total of two holes for the entire cut. Tests were made to determine the best position of these holes in the Pittsburgh bed, and it was found that the best results were realized when they were not more than 12 inches from the rib, drilled nearly flat and parallel to the line of sights. It was shown that where the coal is of a tougher nature, the rib holes should be moved a greater distance from the rib as shown in Figure 8.

EXPLOSIVE USED

Permissible explosives should be used preferably in sizes ranging from 1⅛ by 8 to 1¾ by 6 or 8 inches. The most common practice is to have the hole in which these cartridges are placed about 2 inches in diameter. It is recommended that the larger diameter cartridges be used when it is desired to concentrate the charge in the back of the hole. This is a better practice than slitting and ramming the smaller diameter cartridges into the hole. The holes should be cleaned of all drill cuttings, which are liable to become lodged between the cartridges and may cause incomplete detonation. A reduction in cartridge diameter tends to favor the production of lump coal. For firing the charges an electric detonator should be inserted in the last cartridge so that the loaded end of the detonator points toward the main body of the charge of explosive. After inserting the last cartridge the hole should be filled to the collar with incombustible stemming. The charge is then ready for firing.

The choice of the most suitable brand of explosive depends largely upon trying out explosives of different rates of detonation, because a certain rate in a given coal bed tends toward the production of the maximum percentage of lump. Any rate greater or less than this critical speed will act adversely on the size of the coal produced.

If the above suggestions are carried out and the methods employed are standardized and enforced, the production of lump coal should be improved regardless of natural conditions or methods of mining.

BUREAU OF MINES FUNDS

The Appropriations Committee of the U. S. House of Representatives in reporting the bill making appropriations for the Departments of State, Justice, Commerce and Labor for the year beginning July 1, recommends $1,774,340 for the Bureau of Mines, an increase of $43,390 over the current year, but $755,000 less than the estimates. The reduction is largely on helium, for which the committee allows only $75,000 of the $830,000 requested. The large helium fund was slated for expenditure as follows: 25-mile pipe line to a new gas field at Nocona, Tex., $350,000; new compressor station $130,000; two power units $95,000; helium re-research investigation $80,000; working capital for operation of plants $100,000; general expenses $75,000.

The committee in disallowing the large helium fund said there is already 7½ million feet of helium on hand and that the 600,000 feet monthly output at the Petrolia field will be sufficient to meet the needs of the Army and Navy. For operating the helium plant the bureau will have $500,000 from helium appropriations for the Army and Navy.

Appropriations allowed the bureau for various investigations are: Mine accidents, $396,000; Alaskan mine station, $10,860; mine rescue cars, $277,380; fuel tests, $154,000; mineral mining, $116,100; oil, gas, and oil shale research, $211,000; oil shale mining and testing, $89,000; experiment stations, $173,000, decrease, $25,300; Pittsburgh station, $64,320; mineral resource reports, $123,000.

RELATION OF DRILL HOLES AND THEIR PLACEMENT TO LUMP COAL

Mr. Nelson Considers Preparation Of The Working Face Before Charging Of Holes One Of The Most Important Factors In Producing Large Sizes Of Coal, And Outlines In This Article Those Things He Considers Will Produce The Best Results In Lump Production

By C. W. NELSON, M. S.*

WHENEVER the question of the production of lump coal and ways of increasing the percentage of large sizes is discussed, invariably some person interested in the discussion will attempt to change the topic of conversation to the advantages and disadvantages of black powder, as compared with permissible explosives, in the production of large sizes of coal. As a result, permissible explosive is found guilty of producing a greater percentage of slack coal in blasting, and is allowed to offer no defense.

Since the introduction of permissible explosive in coal mines, the coal mine operator has set up a continual cry for "A slower powder, more like black powder," when in many cases a somewhat faster explosive than was already being used might have been more suitable for the conditions, provided the charges had been properly placed and gauged.

Of all the factors entering into the efficient blasting of coal, preparation of the working place before the charging of the holes has more to do with the production of large sizes of coal than any type of explosive used. By proper preparation of the working place is meant the depth and squareness of the machine cut, the removal of the cuttings or "bug dust" from the cut, and the number, direction, and depth of holes for blasting.

It is impossible in an article of this character to attempt to state the number of holes necessary to bring down a cut of coal, due to different physical conditions found in different seams of coal and even in the same seam of coal in different localities. It will, therefore, be necessary to include only general conditions regarding the placement of holes for blasting and trust that these generalized statements, with variations, may be used in solving particular problems.

It must be realized that the action of an explosive in a drill hole is nothing more or less than the action of a sudden accumulation of a large volume of gases in a confined space, thus building up a high pressure, this pressure being equal in all directions. The gases, attempting to escape, will follow the line of least resistance, opening any weakness planes which are within its sphere of action.

The first problem to be solved in trying to decide upon the proper placement of holes is to study the physical characteristics of the coal to be mined and learn the locations and character of its weakness planes and also where and what the resistant part or parts of the seam are. Having learned the locations and character of these factors, it is necessary to locate the drill holes in such a manner as to take advantage of the physical characteristics of the coal, to bring down the cut with the least amount of shock or shattering to the coal itself.

Consider a seam of coal 6 feet thick, with a very distinct parting between the coal and the roof, and having a clay band 3 feet below the roof; the coal above the band being soft and fragile, and the coal below the band being of a hard and resistant nature. Assume that the above seam of coal is undercut to a depth slightly over 6 feet. If two holes are placed, each at the edge of the undercut and near the roof, the lines of least resistance will be along the parting between the coal and the roof, and toward the front of the cut, due to the most resistant part of the coal being in the lower 3 feet of the seam. In order to break down the lower 3 feet of coal, the force of the explosion would pulverize the softer coal at the top of the seam. To bring the coal down with the least amount of fracture and breakage, it would be necessary to place holes below the clay band, blasting and loading out the coal from these shots before blasting down any of the upper coal. The holes for blasting the upper or soft coal should be drilled as near the roof as practicable, in order to take advantage of the parting between the coal and the roof, thus allowing the gases to spread along the weakness plane and wedge the upper coal down. With this placement of holes, the shock of the blasts is reduced where the soft coal is located, thus reducing the percentage of fines in this portion of the seam. The greater shock is placed in that portion of the seam which can withstand the shock, thus giving better balanced shots and minimizing the fines caused by poorly placed holes.

Now assume a seam of coal similar to the one above, except that the resistant coal is next to the roof, with a distinct parting between the roof and the coal, and the soft coal below the band. It will be necessary now to keep the explosive away from the bottom coal and concentrate the holes in the upper, more resistant coal. In this case, providing the clay band is not of such thickness or resistance as to prevent a good shear along the rib, two holes, drilled near the roof, will give better results and cause less fracturing of the coal than the placement suggested in the last paragraph. Under these conditions the expanding gases will shear the coal from top to bottom, along the rib, and will also act along the parting between the coal and the roof. Should the clay band be of such thickness or hardness as to prevent the top hole producing a shear along the rib, a hole should be placed above the band, and a light charge used to break the band before firing the top shot. This placement of holes is found to give better results than the placement mentioned in the last paragraph, when the top coal is resistant.

It has been attempted, in the above assumptions, to show that in order to get the best results from the shots, the holes must be so placed as to give the expanding gases, generated by the explosion, well balanced loads to move. Any hole so placed as to allow an easier escape for the gases in one direction than in another direction, will require an excess of explosive to move the desired burden, and will consequently produce a poor shot and an excess of fines. Poorly placed holes, causing unbalanced shots, are producers of small sizes and must be eliminated if a high percentage of large sizes is desired. To eliminate poorly placed holes and unbalanced shots, a study of the physical characteristics of the coal seam and a simple application of the principles of mechanics are necessary to determine where and how the holes should be placed to give balanced shots.

Snubbing shots have been recommended by some explosives men as a method for increasing the percentage of large sizes of coal to be obtained from a machine cut. Snubbing shots are not a "cure-all" for lump-coal production. In fact, there are seams of coal in which the use of snubbing shots will cause a decrease in the percentage of lump coal obtained from the cuts. There is a rough test which can be made which will give one a fair idea as to whether snubbing shots will increase the percentage of large sizes of coal or not.

To make this test first make observations of the action of the coal loosened

*Explosives Engineer, Hillman Coal and Coke Co., Brownsville, Pa.

by the first shot, not using snubbing holes, and learn whether the loosened coal from this shot stands in place or rolls forward into the room after blasting. If the coal rolls forward into the room, without the use of snubbing shots, then the results which are desired are being obtained without snubbing, and snubbing shots will not be necessary. However, it will be found that, with a properly charged blast, it will be the exception rather than the rule to have the coal roll forward.

If the coal does not roll forward, place holes for snubbing shots about 26 to 30 inches above the top of the undercut and drill these holes to a depth equal to the height of the collars of the holes above the undercut. The number of holes necessary for the snubbing will depend upon the width of the cut. In a place 10 to 15 feet wide two holes, each one-third the distance of the width of the cut from the ribs and from each other will be sufficient. In 15 to 25 foot places, three holes should be used, equally spaced and one-fourth the distance of the width of the cut from each other and from the ribs. These holes should be charged as lightly as possible to bring down the lower portion of the seam to a depth equal to their depth. These holes should be blasted singly, starting at one rib and proceeding across the face of the cut. After this coal is loaded out, one of the upper rib holes should be charged and blasted. After this blast has been made, observe the condition of the loosened coal from this shot. If the coal near the front of the cut has not been rolled forward into the room, but drops down and remains standing, snubbing will not be found to be an advantage to lump-coal production. If, on the other hand, the coal near the front of the cut has been rolled forward into the room, one may feel satisfied that the use of snubbing shots is worth giving a trial. The method should be tested and the result obtained from the screening of this snubbed coal used to determine whether the increase in large sizes is worth the additional labor of drilling the additional holes or not.

Probably more unbalanced shots are obtained and more coal is pulverized by explosives in low coal than in high coal. In order to produce higher tonnages per man in low coal, many companies have introduced 8 to 10 foot cutter-bars for undercutting this low coal. Invariably the miners drill their holes the same depth as the undercut, thus producing 8 to 10 foot holes in a 3 to 4 foot seam of coal. Under such conditions the explosives, acting along the lines of least resistance, blast down the backs of the cuts and leave the fronts of the cuts standing. These fronts must be brought down, either with short holes and more explosives or with digging by the miners. Either method produces an excess of small sizes.

To blast this type of coal efficiently a study of the seam should be made to determine the relative resistance of the coal toward the front of the cuts and toward the tops of the undercuts. After this the holes should be drilled to such a depth that the resistance offered the explosives in these two directions will be the same. The depth of these holes will have no relation to the depth of the undercut, but will vary in a direct proportion to the height of the coal.

One hole should be shot at a time and the coal brought down by each shot should be loaded out before the next hole is blasted. The face of the room should be squared up, and a second round of holes drilled to the back of the cut and these holes blasted one at a time, and the coal from each shot loaded out before the next shot is fired.

There are certain factors influencing the production of large sizes of coal in any seam, regardless of its thickness or general characteristics. A discussion of these factors follows.

The sides of the undercut should be parallel to the line of advance for the room or entry. Gouging by the machine men causes the coal to wedge or bind as it is moved forward by the blast, and makes it necessary to use an excessive amount of explosive to break the coal down. This increases the percentage of small sizes of coal produced. Careful supervision of the cutting will stop the practice of gouging.

The failure of the machine men or miners to remove the cutting or "bug dust" from the cut reduces the volume allowed for expansion of the coal loosened by the blasts. This causes the loosened coal to become tightened toward the back of the cut, due to the lack of room for expansion, and makes it necessary for the miner to dig a channel through this coal before he can load it. This additional pick work increases the percentage of small sizes.

In mines where the miners drill their own holes it is customary for them to drill the holes parallel to the sides of the undercut. If the machine men have gouged the ribs, the backs of the drill holes are often located in by the normal ribs of the room or entry. Holes so located will increase the resistance toward the front of the cut and makes the lines of least resistance be toward the undercut. This practice makes it necessary to use excessive amounts of explosives and produces poor shears along the rib. Rib holes should always be drilled parallel to the line of advance for the room or entry, and should be slightly shorter than the depth of the undercut. If the cleavage planes are not vertical, then the depth of the hole should vary with the inclination, providing the working places are advancing perpendicular to the strike of the cleavage planes.

Pop-shots or short, unbalanced holes, used to bring down portions of coal, are indications of poor blasting practice and should not be permitted except in rare cases.

The blasting of more than one hole before loading out the coal from the first blast generally causes a decrease in lump-coal production and should not be permitted. There are certain exceptions to this rule, one of them being the method suggested earlier in this paper, where it was necessary to break a resistant band in order to provide a good shear. In general, all coal should be loaded out from one shot before a second shot is fired.

The tight or opening hole for a cut should be made near the edge of the cut, as less explosive is required and a better shear is produced at this point than when the hole is located nearer the middle of the cut.

The less the spread of the opening shot, still allowing the miner to shear to the back of the cut, and the bigger the remaining shoulder, the greater will be the percentage of large sizes of coal obtained. The reason for this is that the remaining shoulder has three directions in which to expand, while the opening shot has only two directions in which to expand. The above statement is not true beyond certain limits; it is possible to so concentrate the action of the explosive on the opening shot as to pulverize this coal and under these conditions the increase in fines from this shot might overbalance the increase in large sizes obtained from the shoulder.

In order to obtain proper placement of holes to produce large sizes of coal constant supervision of the blasting practices is necessary. This supervision should be delegated to one man who understands the different types of explosives on the market and their action upon different coals. This man should cooperate with the officials of the mine or mines in studying the characteristics of the coal, and when a certain placement of holes for blasting is recommended the placement decided upon should be enforced and variations should not be allowed.

One might justly say that the relation of drill holes and their placement to large sizes has as an objective the placement of drill holes in such a manner as to produce well-balanced shots and obtaining the maximum efficiency from the amount of explosive used to charge these holes.

BLASTING FOR LARGE SIZES IN LOW VOLATILE COAL

Removal Of Bug Dust From Cut Before Blasting Is Regarded By Mr. German As Highly Important To Successful Results—Impractical To Generalize In Regard To Explosive Best Suited For Low Volatile Coal

By W. J. GERMAN*

THE LOW volatile coal seams are the most difficult coal seams to blast, especially when it is important that the least possible quantity of slack or fine coal be produced. The sponge-like nature of this type of coal causes it to absorb the shock given by the explosive more than does hard, high volatile coal, and if proper care is not taken in placing, charging, and confining the shots, the results of the blasting will not be satisfactory. Because of the very soft nature of this type of coal, especial attention must be given to charging the shots. An excessive explosive charge will cause unecessary shattering and a large portion of the coal will crumble into slack.

One of the principal seams in the low volatile field of West Virginia is the Sewell seam. This ranges in height from 36 to 40 inches and in most operations it is cut at the bottom. The two other principal seams in this field are the Pocahontas and the Beckley. As a rule, these run thicker than the Sewell seam. Since the seams of low volatile coals mined in other states are similar in characteristics to the West Virginia seams named, these three can be taken as representative. In a number of mines where the coal runs 6 feet and over in thickness, it is cut in the center with arc wall machines, making two thin benches to shoot. When this is done, blasing conditions are rendered similar to those in the Sewell seam, so the point I want to make applies to both the thin and the thick seams.

*E. I. du Pont de Nemours Powder Co.

In my visits to hundreds of mines in the low volatile fields I have found that many operators who mine the thin seams and many operators who cut the thick seams in the center are using explosives of the same diameter and of the same density as used by the operators who mine the thick seams cut on the bottom. Under the first two conditions the coal is being overshot about 50 percent.

It is plain to be seen that the same type and size explosive should not be used in a 3-foot seam as in a 6 or 7-foot seam. In a 6-foot seam undercut to a depth of 6 feet, an explosive charge in the back of the bore hole will have an equal resistance to work against in both directions and the explosive force will generally spread through the whole block of coal; but in a 3-foot seam undercut 6 feet, the resistance from the back of the bore hole to the undercut is only half that from the back of the hole to the face and consequently an explosive charge concentrated in the back of the hole will shatter and pulverize most of the coal at the back of the cut. Viewed from the front immediately after the blast, such a shot may seem to have proudced only block coal but when the loader digs into it, the coal at the back is found to be largely slack. To prevent this, the charge in a thin seam of coal should be lengthened out in the bore hole instead of concentrated in the back. This method of loading was not always practicable with the earlier types of permissibles but within recent years explosives manufacturers have developed bulky, slow permissibles which can be used satisfactorily in diameters as small as 1⅛ inches. Where these explosives have been put into use in thin seams, the percentage of fine screenings has been greatly reduced.

In mines that are free from gas and dust, black powder may be the explosive needed to produce large size coal, but this is not always the case. I have seen black powder in use in mines where permissibles would have given at least an equal percentage of lump coal with greater convenience and less hazard to the miners. On the other hand, in some mines the offi- (*Continued on page* 221)

Photographs showing what can be done in low volatile coal seams in the way of producing large sizes when the suggestions outlined in this article are followed

CONTROL OF COAL SIZES WITH UNIFORM PREPARATION, DRILLING AND SHOOTING

A Description Of Methods Used And Results Obtained At Island Creek Coal Company's Properties Where Experiments Have Determined That Proper Snubbing And Loading Out Of All Bug Dust Are Necessary To Successful Blasting

By HOWARD M. SHAUL*

ANTIQUATED methods of shooting coal have long ago been relegated to the discard and newer and more up-to-date methods have been devised and put in use, thus insuring greater safety to the miners, cleaner coal, and better preparation. A review of the procedure of shooting coal used in the mines of the Island Creek Coal Co. at Holden, W. Va., might be of interest.

The Island Creek seam runs in thickness from 6 to 7 feet and consists of a hard splint coal, together with a semi-gas, the semi-gas being both on top and bottom of a thickness of from 8 to 10 inches. This seam is practically free of slate or bone.

The coal is undercut with Sullivan Short Wall Machines to the depth of 7½ feet, leaving 2 to 4 inches of coal on the bottom, which is scrapped by the miners after having loaded out the cut. Owing to the hardness of this coal, the company bores all holes for the miners, using a Jeffrey Electric, Type A, No. 5, rotary drill, hauled on a specially built truck, on which are carried the augers, oil, and all tools necessary to the proper maintenance of the drill. An Emory grinder is also installed on the truck for use in sharpening the augers.

Upon reaching the face to cut, the drill is taken from the truck and set up ready for action. The drilling is done off of the motor cable with the use of a short cable connected to the motor.

The drilling of all bore holes is done at night. The drill crew consists of two men, who haul the truck containing the drill and equipment from place to place, with a haulage motor. Each drill crew averages 1,000 tons of coal per shift of eight hours.

The bore holes average 2½ inches in diameter, thus insuring the proper placing of the powder, viz, in the back end of the hole. All holes are bored to a depth of about 7 feet, or within 6 to 8 inches from the back of the cut, and particular pains are taken that no holes are on the solid. The center holes, as well as the rib holes, range upward and are bored to within 4 inches of the sandstone top. The rib holes are bored on an average of 12 inches from the rib. Owing to the smoothness of the top the coal comes away very easily, and it is very seldom the miner ever uses his pick in getting down the top coal.

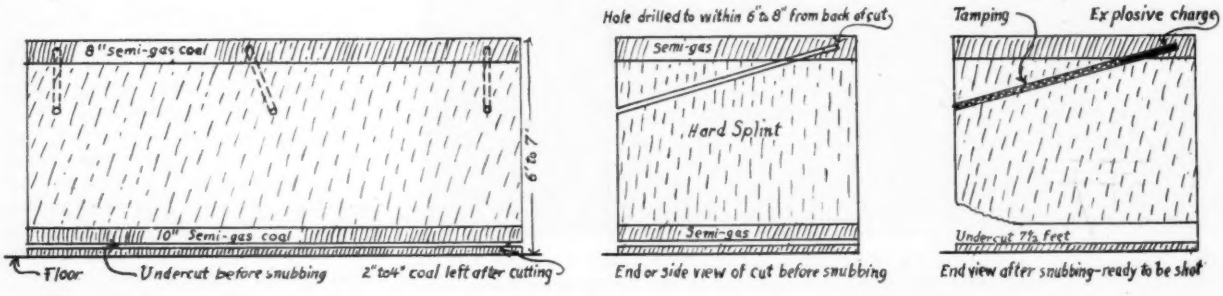
Upon entering the mine in the morning the miner finds one or more cars at his working face—two, if it be a double track room and one on entry or narrow work. Constant supervision by the superintendents, mine foremen, and inspectors has brought about wonderful results in the shooting of this coal. When a new coal loader enters any of these mines, he is taken in charge by one of the inspectors and conducted to his working place. The inspector explains to him that all bug dust or coal cuttings must first be loaded from under the cut into the car and the place thoroughly made clean of any cuttings. He is also shown how the coal is to be "snubbed" before any holes are loaded with explosives. A special bug dust shovel, perfectly flat, with an 8-foot handle, is used for this purpose, which is quite a contrast compared to the old shovels used a few years ago, which were made from old worn-out coal shovels, and usually had a paw-paw or sassafras handle that, if handled with care, might last one week.

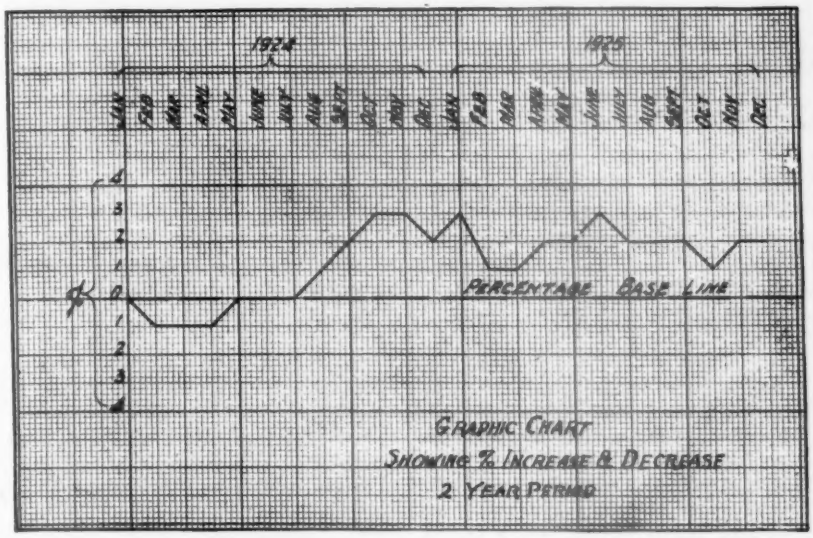
The next procedure is for the miner to take his 4-foot bar and separate the soft coal just about the undercut from the hard splint. This soft coal is about 6 inches in thickness and usually swags or pulls away from the hard coal after the undercutting is done. This coal is taken out as far back as 3 feet from rib to rib, and quite often nearly to the back of the cut. The coal is then snubbed to a height of about 18 inches from the floor toward the back of the cut at an angle of about 30 degrees. The miner then cleans from under the cut the coal taken down with his bar and pick cuttings, thereby insuring a good free breakage and falling of his coal after shooting. The miner now cleans out each bore hole and proceeds to charge his breaker or middle shot with his explosive.

After shooting the breaker shot all coal is loaded out that is possible for the miner to get, and not until then is either left or right rib shot. This insures the miner a minimum amount of powder to be used in either rib, thus giving the minimum amount of smoke or fumes from an overloaded shot, and at the same time insuring to the company the maximum amount of lump coal. It might be added that the method of loading out all the coal from the breaker shot, thus reducing the charge in the rib shots very materially lessens the chance of a blown-out or windy shot. All holes are tamped to the mouth of the bore-hole with clean clay, free from grit or stones, which is brought in the mines from the outside and placed at convenient points for the miners' use. The writer has reason to know that no alibi given here would be of any avail if one were caught using any other tamping but clay, as the "clay" is always there.

Paper-cartridge tubing, 2 inches in diameter, is used, the tubing being in 50-foot lengths and scaled to inches on outside. No guesswork is employed in its use, as one has a uniform cartridge in diameter and the miners know how

*Explosives Engineer, Huntington, W. Va.





many inches of powder is being used in the length of the cartridge.

Du Pont black blasting powder is exclusively used in all mines, with the exception of the two shafts where Monobel 5 is exclusively used. No fuse or caps are allowed in any mine, all shooting being done electrically, using No. 6, 7-foot iron wire electric blasting caps and a small earphone battery, which lasts the miner from three to four months.

Miners' squibs are used for the setting off of the black blasting powder, except in some cases where the miners desire to use electric blasting caps, to which there is no objection.

It might be added that since the adoption of electrical shooting the number of accidents has been materially reduced, as the miner can now no longer have any excuse for the use of the 10 to 12 inches of short dummy stemming or tamping where fuse and caps are used.

The manner of teaching the miner the proper method of preparing each cut and the method of shooting was not brought about without some difficulty, but after the miner has been taught that by the proper snubbing of his coal, loading out all bug dust and all coal from his breaker shot before shooting the ribs, that less powder could be used, thereby saving him money, and that more lump coal could be produced, it is rarely any coal loader is found to be not willing to cooperate with the mine officials to the fullest extent.

After a very intensive educational campaign on the proper method of preparing each cut, the drilling, tamping, and shooting, it was recognized that a maximum percentage of lump coal was reached by January 1, 1925.

I have had prepared, and am here presenting, a chart which shows the average decrease and increase over this maximum base line percentage during the years 1924 and 1925. In looking at this chart you will note that there was only three months—February, March, and April, 1924—that went below the base line. The next three months stayed on the base line, and the increase over the base line from then until the present time has been very marked. This graphic chart shows very conclusively that careful watching of the shooting methods used by the miners is very productive of results.

The accompanying sketches show the face and sectional view of cuts before and after coal is snubbed.

BLASTING LOW VOLATILE COAL

(*Continued from page* 219)

cials insist upon permissibles when there is no real necessity for their use and black powder would give far better results.

In a word, it is impractical to generalize in regard to the explosive best suited for low volatile coal. If the results which are being secured in any particular mine are not satisfactory, it is advisable for the operator to get a field man of one of the explosives companies to make a study of blasting problems there and then to test in a thorough manner the explosive and the blasting practices which he recommends. Some of the explosives companies issue service bulletins which are prepared by men who devote most of their time to work in the mines and which discuss various phases of the coal-blasting problem in a practical way.

Another common practice which is detrimental to the production of lump coal is that of shooting the coal down on top of the bug dust. With the present day high speed bottom cutting machines, much of the cuttings, or bug dust, is carried back and crammed tight in the back of the undercut. Unless this dust is cleaned out the coal does not have a free space to break down into and the benefit of undercutting is lost. This is one of the most important requirements for successful blasting in the low volatile coal mines and probably the one that is most frequently neglected. Only a few of the mine officials make it their business to see that all the bug dust is removed from the cut before blasting. One of the shovel manufacturers has recently put on the market a specially designed long-handled bug dust shovel and this should lead to proper dusting of the cut in a greater number of mines.

From a lump coal standpoint, the operation of primary importance in coal mining is the blasting, yet in most mines this receives less attention from the mine officials than any other operation. Coal production starts at the point where the miner puts off his blast. After the selection of the explosive and determination of the most effective methods of charging according to expert advice and test in the mine, supervision of the blasting is the most important factor in the production of block coal. If the coal is overblasted all preparations for the proper loading and handling of coal to yield large sizes are of no avail. When mine officials from the manager down to the section foreman show active interest in the blasting problem and assume responsibility for the use of the proper practices, better results are bound to be obtained and this is the one sure way to secure a maximum of large size coal.

The Austin Co., engineers and builders, headquarters Cleveland, has been awarded a contract for the design and construction of a new mixing plant by the West Coast Fertilizer Co., Tampa, Fla. This company manufactures about 20 different kinds of fertilizer, used mostly by citrus fruit growers. Dry mixing only is employed, using fish, guano, phosphate, and bone as principal ingredients.

The old plant of the West Coast Fertilizer Co. was destroyed by fire a few months ago. It is being replaced by a modern steel frame building of single-story design. The dimensions are 120 by 300 feet. Approximately 200 tons of structural steel will be used. Construction is to start January 20 and is to be completed May 1, according to the schedule of the Austin Co. This project will represent an investment of $100,000 and will be similar in size and design to the Lyons Fertilizer Co. plant already under construction by Austin at Tampa.

The West Coast Fertilizer Co. has been established about eight years. J. H. Blake is president; E. H. Folk, vice-president; and R. B. Campbell is secretary and treasurer.

THE NATION'S VIEWPOINT

A Digest Of The Expressed Opinions Of Leaders In American Affairs

THE New York *Journal of Commerce* believes that the campaign of the railroad workers for higher wages is preeminently a public question and that the public should be fully informed concerning the merits of their demand. They further state:

"In initiating a campaign for higher wages which, if fully successful, would add something like half a billion dollars to the annual railway operating expenses of this country, the employes of American railway companies have forced a situation that demands some careful and courageous thought on the part of the public. The men involved are today receiving money wages that lack but little of being as high as they were at the peak in 1920. They are enjoying far and away more real earnings than they ever before had in their lives. What possible reason or excuse can they then find at this time for demands such as they are so busy making? There can be but one real answer no matter how the real issues may be concealed or disguised by arguments seeking to make the worse appear the better reason. The campaign for generally higher wages now being insistently carried forward has its roots in the improved earnings that the transportation industry has been reporting during recent months, and in nothing else. * * *

"This is par excellence a public question. It is one that in the end public opinion will decide, quite regardless of any and all machinery that may be set up to control the situation. The rank and file of the people must be kept well informed on this subject and opinions thus stimulated must in some way be rendered articulate and effective without undue delay."

In commenting upon the bill now before Congress concerning railroad labor disputes, *Law and Labor* says:

"This bill leaves the question of industrial peace entirely within the keeping of the parties, and fails utterly in adequate provisions by which the public may know what an industrial dispute is about, if one does occur.

"It has been widely proclaimed that what is needed in the basic industries is provision by which the public may discover the truth about industrial disputes, and so take an intelligent attitude toward the disputants, which will presumably force the settlement of the dispute on terms reasonably consistent with the public welfare. The United States Fact Finding Coal Commission made a permanent public fact-finding commission for the coal industry its major recommendation. A large body of public opinion came to the support of this proposition, yet no measure has been framed. In the meantime the carriers and the railroad unions had brought forward this measure, and the announcement that they have agreed upon it promises to surprise citizens into the notion that it must be a good thing and that nothing more is needed. Thus while an insistent demand is made for a public

Wallace Press-Times

How to Play Safe

Wallace Press-Times

Herbert, the Giant Killer

N. Y. Evening Post

All Over but the Shouting

Wall Street Journal

So Far as We're Concerned

fact-finding commission in coal, similar to the Railroad Labor Board, it is now announced that the Railroad Labor Board is to be thrown out of the window because neither the carriers nor their employes like the board.

"They do not favor a public board with adequate inquisitorial power. They do favor a measure permitting them to do all those things which they may now do without any public enactment and not requiring them to do anything they might not care to do, with the single exception that the carriers will not change rates or conditions while the President may be looking into the dispute, and for 30 days thereafter, and, further, putting the burden of the cost of a board of mediation—a minimum of at least $100,000 annually—upon the people. No public agency is created with power to subpoena witnesses and take testimony under oath as to any dispute that may interrupt interstate commerce. No limitation is placed upon the right of employes to quit at the arbitrary decision of a trade union official, save for the single provision that if the board of mediation shall notify the President that a dispute threatens 'substantially to interrupt interstate commerce to a degree such as to deprive any section of the country of essential transport service,' and if thereupon the President chooses to do so he may create any kind of a board he chooses to investigate the dispute, and after the creation of such a board, and for 30 days after it has made its report to the President, no change except by agreement shall be made by the parties to the controversy 'in the conditions out of which the dispute arose.' Of course this is not even the equivalent of saying that the workers may not strike during this brief period in the course of the dispute, and under the act they are certainly free to strike at any other time. The act throws overboard the limited measure of protection which the Railway Labor Board now affords the public interest. It substitutes nothing of consequence in its place. It does not compel the parties to pursue a reasonable course when an industrial dispute occurs, but merely outlines a reasonable course which, if they desire to be fair with one another, they may follow. Whether they are fair to the public or not remains to be seen. The bill leaves it up to them."

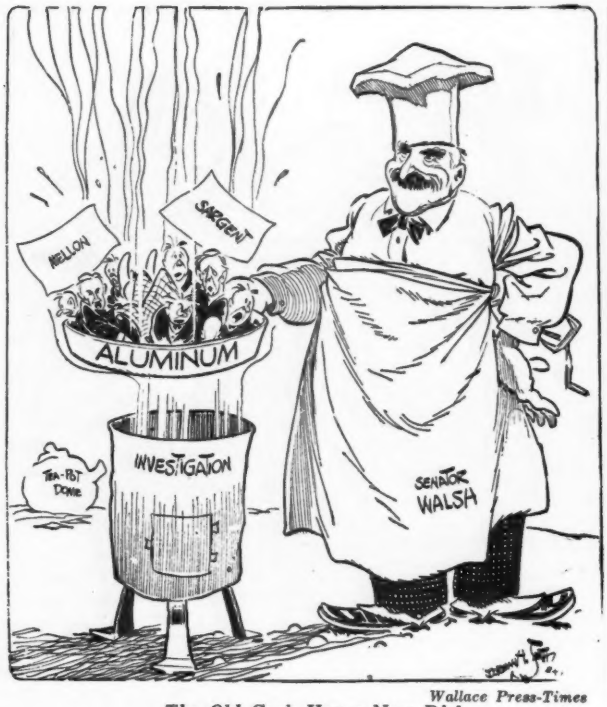
The *Locomotive Engineers Journal* takes just the opposite view and endorses heartily the labor bill now before Congress:

"The Railroad Labor Act is based on sound past experience and not on some untried theory. It follows in the main the provisions of the Howell-Barkley bill introduced in the last Congress, the principal change being in the origin of the adjustment boards and the method of arbitration. The mediation section of the bill is patterned after the tested Newlands Act of 1913, while the arbitration boards are similar to those legalized by the Erdman Act in 1898. The joint boards of adjustment, formed by the duly elected representatives of both parties, are much like the boards established during the war, which successfully adjusted all but 12 out of thousands of cases handled.

"Neither the railway unions nor the rail managements pretend that the new bill gives them everything they wanted. Yet the important fact is that after months of patient negotiation and concession, both sides were able to agree upon an acceptable foundation for industrial peace."

The repeal by Congress of the capital stock tax has met with the approval of the mining industry generally and of the press. *Engineering and Mining Journal-Press* in a current issue in commenting on this subject says:

"A good step forward has been made by the United States Senate, not so much in repealing the capital stock tax as in combining it with the income tax, thus eliminating duplication of work on the part of the taxpayer as well as on behalf of the Government. So long as it is necessary to raise a specified sum for Government purposes, it should be done by one operation instead of two, as has been the practice for a number of years. The capital stock tax is an excise tax, a charge on the privilege of doing business, and is calculated at the rate of $1 per thousand dollars on the fair



Wallace Press-Times

The Old Cook Has a New Dish

San Francisco Chronicle

Perpetual Motion

value of the capital stock. It is payable in advance in July for the following fiscal year ending June 30, and yields about $95,000,000 per year. The Senate did not feel that this amount could be entirely eliminated at present and did the next best thing by increasing the income tax on corporations 1 percent, making the new rate 13½ percent in place of 12½ percent, as in the 1924 law, and repealed the capital stock tax without substantial loss to the Government.

"Under the 1924 law the corporation has to run the two fiscal years contemporaneously, one on a calendar year basis for income tax purposes and one expiring six months later for capital stock tax returns. On July 1 it makes the return for capital stock tax and has to strike a balance sheet to show not only its earnings but the estimated value of all its property and the estimated value of its stocks from time to time during the previous year. The Government, with another set of auditors and another set of examiners, in a different division in the bureau, calculates the estimated fair value of the capital stock of that company and assesses the capital stock tax. Under the present law the income tax unit audits another set of returns filed on March 15, by the same corporation, on a calendar year basis, and has an independent corps of field auditors who examine the records at the corporation's home office. Under the amendment as it passed the Senate, the taxpayer will make only one return; will audit his accounts once instead of twice for tax purposes, place only one value on his holdings, and have one fiscal year in the place of two, thus saving a large amount of clerical work and annoyance. Each corporation now goes through twice as much accounting and the Government itself goes through twice as much auditing as is necessary to get the two taxes for the year out of the corporation.

"Whether the corporation is large or small, it should welcome this change in the matter of reducing its own expenses as well as the Government's expenses in administering the law. Reduced Government costs should in the long run mean further tax reduction.

"Valuations set up and accepted for capital stock tax purposes and those set up for the income tax purposes are often the cause of delay in settlement of income taxes. Income tax auditors maintain that the sworn valuations set up for capital stock purposes should be the value upon which depletion should be based. The taxpayer, however, is not satisfied with this arrangement; hence opportunity for 'bargaining' a settlement.

"To assure that the capital stock tax may be low, an undervaluation is often made, while a high value is insisted upon for income tax purposes when establishing depletion and depreciation deductions. There can be only one true value, and this value should maintain in both cases. One of the causes of delay in closing tax cases is thus removed.

"Consolidation of the two taxes is an advantage to any corporation as well as the Government. For corporations earning 10 percent it means practically no change in the amount of taxes paid, and for those earning in excess of 10 percent on the fair valuation of the capital stock it means a slight increase in taxes which will in a large measure be offset by reduced expense in filing one return in place of two as at present. Corporations with no income will pay no tax. On the whole, however, it will eventually mean a slight reduction in taxes, and a great saving to the Government in the matter of administration.

"Duplication of work in the Government bureaus is an important cause for maintaining high taxes. As soon as work becomes current, the capital stock tax unit can and should be discontinued. Any steps that will simplify or eliminate duplication of effort in Government bureaus should be hailed with gratification on the part of all taxpayers."

Since the anthracite agreement there has been considerable discussion as to which party in the controversy won. The *American Metal Market*, however, does not believe that this is the important thing to consider in the anthracite settlement, and says:

I Talked Too Much

Brooklyn Eagle

The Sphinx Speaks

Wallace Press-Times

"The consumers of anthracite are interested to know what anthracite is likely to cost them in future and to what extent they are likely to be free from uncertainty as to supplies. The matter from this angle is important only in certain quarters.

"The bearing of the anthracite settlement upon the general labor, industrial and economic situation, is, on the other hand, a matter of fundamental interest to all business men. Along this line some points may be discussed.

"The adoption of a five-year arrangement may be taken as recognition alike by both parties to the dispute that the public would not tolerate another anthracite suspension. We have had at least one anthracite suspension too many already. Another would certainly cause something to break out. The public would not grow more tolerant between now and that next time. Common thought would progress along the line that we have or ought to have graduated from such things.

"The settlement involves arbitration during the five years. There was quite skillful juggling of words to keep the expression out of the statement, but arbitration is exactly what is meant. Hardly anyone will doubt that the main reason Mr. Lewis rejected arbitration was because he wanted, and thought he could get, more than arbitrators would award. The operators may deserve some credit for repeatedly offering to arbitrate, but not a great deal, as obviously it was plain tactics to press something popular which it was known the other side would reject.

"The nub of the matter seems quite clearly to be in how the matter of the check-off will be worked out. If the men do not get a very considerable quantity of this the union is likely to languish. The men will be less keen than formerly to keep up the union, now that they see they have an agreement for five years.

"If they do get rather a full check-off the case will be different. The union bituminous miners have it in complete form, but they do not have much pay roll from which to check off dues, fines, assessments, etc.

"The check-off is all wrong. It is simply automatic unionism. It causes the employer himself to support the union. Lest anyone think we may be taking too much upon ourselves in saying this, we cite as our authority the operators themselves who committed the crime of 1898. The cynical may say it was worse than a crime, it was a blunder. Those operators had two things on their backs, the nonunion operators and the union, and that was one too many. Finding themselves unable to shake off either, they gave the union the check-off, thinking the union would then rid them of the nonunion operators. It did not work that way, and most of the coal trouble since has been due to that crime and blunder.

"Economically speaking, a few years ago the country was burdened with three monopolies, the unions of building trades artisans, the railroad unions, and the United Mine Workers. Building unions are making much less trouble than formerly, the railroad workers are getting what they deserve and are content with it, and there has remained the United Mine Workers as the chief drawback to sound economic conditions in this country. Hence the chief interest now is to see how much automatic unionism the anthracite trade is going to have."

Coal Age is firmly of the opinion that the operators have won the battle, saying:

"Shorn of pretense and smoke-screenings, the victory was to the public and to the operators, and defeat to the dogged leader of the union forces. The union 'vowing it would ne'er consent, consented,' to arbitration, although the forbidden word was kept out of the simple document which recorded renewed cooperation. The check-off, also excluded by name from this document, was circuitously referred to in a paragraph which specifies that it and other inside arrangements between operators and union officials shall be the subject of 'negotiation.' The demands of the miners for fixed wages for five years—an impossible economic condition—were successfully resisted; and afterward they lessened the demand to a two-year fixed wage. The crumb which the union finally obtained was a fixed wage scale for less than a year and after that a wage subject to arbitration. What private understanding, if

any, the opposing sides may have other than the signed agreement is, of course, not certain; but it is certain that the operators, backed by the public and by the President, have been able to resist arbitrary and ruinous demands which could only have led to economic and social disaster. This conclusion is accentuated by the loud peals of victory given off from the headquarters of the union leaders, while the operators maintain a demure and resigned attitude. If there was any private understanding concerning the terms of settlement, one is inclined to think it was that Mr. Lewis should be allowed to roar to his followers that he had achieved a great victory and be permitted to 'get away with it.' And there is no doubt that his misguided followers, impoverished and without advantage, will believe that they have won, and experience the joy and contentment that goes with it."

Providence Journal

Get Out of the Way

Industry, published by the Associated Industries of Massachusetts, does not believe that anyone has won the anthracite strike, in spite of the fact that the workers have returned and that the mines are in operation. In a recent editorial, they say "Who Won":

"The mine workers? They lost nearly six months time, or $158,000,000. That's gone forever. They can not get it back. Six months taken right out of their lives as far as production is concerned. Privation and worry shorten life. The physical and mental suffering of the mine workers and their women and children during the greater part of the strike must therefore be accounted an added economic loss—enormous and irrecoverable. A big price, surely. What have they got for it? 'Optional' instead of compulsory arbitration! A way open for future strikes—further losses and suffering for the mine workers and their families! The leaders claim to have won something that means the 'check-off.' A victory for the union, maybe, but hardly a victory for the mine workers, for the 'check-off' is simply a means of compelling them to pay dues and fines to the union. Clearly, therefore, the mine workers did not win the strike.

'The operators? Coal production was curtailed 35,000,000 tons, a loss of $366,800,000 to mine owners and all elements entering into the handling of coal between the mines and the consumers. What have they won? They fought for compulsory arbitration but got only a poor compromise. They secured a five-year contract without advancing wages. But either side may make new wage proposals within a year, and breach of contract seems to have been no uncommon thing in the anthracite coal industry. Meantime the operators have lost their grip on the New England domestic coal trade and must win it back to where they were before the strike—minus nearly half a billion dollars. Victory?

UM-M-M-M-M-
AMERICAN AVIATION
NICE BIRDIE, THIS OUGHT TO PUT SOME PEP IN YOU
2½ MILLION DOLLARS
GUARANTEED TO DEVELOP WING STRENGTH

Wallace Press-Times

Ah, Food!

"Who won the strike? No one—yet."

The *Black Diamond* does not consider who won the strike the important feature. They consider the most important thing in the settlement of the strike is the certainty that production will be maintained for five years. They further say:

"The most important feature of the settlement of the anthracite strike is the certainty that production will be maintained for five years. This will make anthracite a dependable fuel again. Of nearly equal importance is the continuation of the old wage scale. The industry need not further fear cheaper domestic fuels through an enforced increase in anthracite prices. Thus anthracite returns to the market and will not be subject to the whims of labor leaders for some years. Controversies are to be referred to a board 'with full power and without reservation or restriction, and the parties agree to abide by any decision or decisions of such board.'

"The board shall consist of two men. One each is to be selected from a list of three named by the other side. Unless agreed, the men named shall not be connected either with the United Mine Workers or with the 'business of mining coal.' This board must reach a decision in 90 days and may increase its membership to an odd number, with a majority vote binding. Until August 31, 1930, there can be no interruption of mining. Adjustments of the wage scales upward or downward can be made on the proposal of either party not more than once a year, if miners and operators agree to the revised scale, and, disagreeing, a board certain of reaching a binding decision will be available and disputes will be settled with fairness and speed. There will be no strikes.

"There is no need for reviewing the strike of record length. Lewis yielded at every point. The public and the operators stood without flinching against higher wages and prices—and won. They demanded c o n t i n u o u s production without strikes. They opposed the check-off. They insisted on 'modern methods of adjusting industrial disputes.' In every instance they succeeded in their stand. Perpetual arbitration has not been achieved, but the principle of arbitration has been introduced

definitely in the anthracite industry for the first time as a means for settling differences when they arise.

"Neither the monopoly of anthracite labor in Pennsylvania nor the seeming dependence of the eastern public on anthracite have sufficed to carry Mr. Lewis along in his arrogant policy of ruining the anthracite industry. It is not possible continuously to flout the public, and Mr. Lewis has had that lesson. Nor is it possible to flout economic laws and succeed indefinitely. One wonders if Mr. Lewis will turn to the expiration of the Jacksonville agreement with greater vision and more common sense than that displayed by him in 1924 and 1925, in which years he led his followers in the bituminous and anthracite industries to destitution, achieving nothing."

Wallace Press-Times

Now Come the Bumps

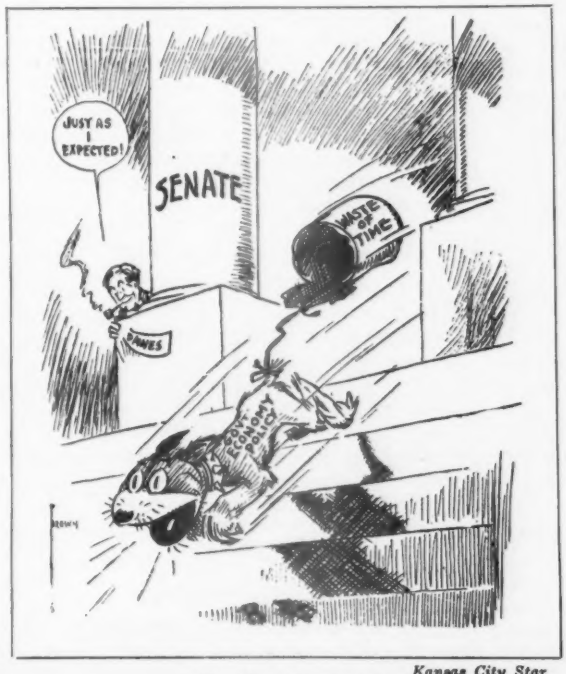
Since the anthracite controversy is settled, it is certain that Congress will take up recommendations for coal's regulation. In commenting upon the bill now before Congress providing that coal shall be regulated by the Interstate Commerce Commission, and the announcement of James S. Parker, chairman of the House Committee on Interstate and Foreign Commerce, that his committee will take up the recommendations of President Coolidge in regard to regulation of the coal industry, the *Traffic World* believes that if the Commerce Commission should undertake to regulate the coal industry it would mean the Commission's destruction. They further say:

"Regulation of the coal industry may or may not be necessary. The issue which has now been raised is whether, if there is to be regulation of the coal industry, the regulator shall be the Commission. The Commission, if what is being said in Congress about it may be taken as an indication, is having a difficult time regulating the railroads to the satisfaction of a considerable number of members of Congress. With an industry that has such vexatious problems as has the coal industry, what would be said by members of Congress with respect to action of the Commission in regulating that industry?

"Not questioning in the least the sincerity of the members of the Coal Commission who recommended that the Commission be empowered to regulate the coal industry, it may be said that, if abolition of the Commission by indirect methods were desired, probably not a better course could be pursued than to delegate to it the power to regulate the coal industry.

"As the country grows and the transportation systems grow with it, the responsibility of the Commission, as regulator of the railroads, grows. Even if there should be no further increase required by law in its duties in that respect, its duties will naturally become greater in number rather than fewer.

"The argument that coal and transportation are so linked together that the logical body to regulate the coal industry is the Commission may be applied with equal force to any other large industry that may be brought under the regulatory power of the Government. These things seem so obvious that it should not be necessary to call attention to them, but it will be necessary to call the attention of Congress to them when the House Committee on Interstate and Foreign Commerce begins hearings on proposed coal legislation."



Kansas City Star

Canning the Watch Dog

Mining Truth, published by the Northwest Mining Association, takes violent issue with the recommendations of Secretaries Jardine and Work endorsing a bill proposing to amend the mining laws applicable to lands within the national forests, which, they assert, will prevent locators and owners of mining claims in national forests from acquiring surface rights other than to enable them to work their claims or mines. They further state:

"In a letter urging passage of this bill, both Secretaries assert there has been much abuse of existing laws; that many fraudulent claims have been filed, primarily to obtain use or control of timber, forage, mineral springs, damsites and other natural resources of value, and that in other instances claims have been far more valuable for surface resources than for mineral.

"Fraud is one thing—and strangulation of the nation's greatest industry is another. There have been cases, as everybody knows, in which mining claims have been staked out for other than mining purposes.

(*Continued on page* 232)

Mining Men Organize to Further Research Work On Iron Ores

Research work directed toward the solution of problems vitally affecting the future of the iron-mining industry of Michigan, principally the development of economic methods of beneficiation of low grade and high sulphur ores, has been started at the Michigan College of Mines. This comes as a result of a meeting held at Houghton, Mich., February 5 and 6, at the call of President W. O. Hotchkiss of the Michigan College of Mines, where representatives of the iron-mining industry effected a permanent organization to sponsor this work.

At this meeting R. C. Allen, vice-president of Oglebay, Norton & Co., Cleveland, Ohio, was elected chairman of the organization, which will be known as the Iron committee; M. C. Lake, Duluth, Minn., geologist for the M. A. Hanna Co., secretary; and O. C. Davidson, Iron Mountain, Mich., general superintendent of the Oliver Iron Mining Co., chairman of the executive subcommittee. Other members of the subcommittee are A. D. Chisholm, Ironwood, Mich., district manager of Pickands, Mather & Co.; J. E. Nelson, Negaunee, Mich., range manager of the Republic Iron & Steel Co.; E. D. McNeil, Bessemer, Mich., general superintendent of the McKinney Steel Co.; and M. C. Lake, Duluth, Minn. These men will act as a "steering" committee and will make definite proposals to be acted upon at subsequent meetings of the main iron committee. It is expected that the next session will be held at the Michigan College of Mines, in July or August.

High sulphur ores are already receiving the attention of a group of Michigan College of Mines seniors who are working along lines outlined by Prof. A. T. Sweet, head of the metallurgy and ore dressing department. Work at present consists of determining the amount of sulphur in the ores, the physical and chemical properties, and investigation into the scheme for the removal of sulphur.

As suggested by the iron committee, work has been started on the collection of data bearing on probable future consumption of iron ore and general economic problems affecting the iron and steel industry. Copper is likewise being investigated along similar lines.

The industry itself, the Department of Research of the University of Michigan, the Michigan Geological Survey, the United States Bureau of Mines, and the Michigan College of Mines will cooperate in the work of research.

Homestake Gets Additional Property

The Homestake Mining Co. has recently purchased the Oro Hundo property, immediately adjoining the Homestake property on the southeast, in the Black Hills of South Dakota. This tract was formerly owned by the late John T. Milliken, of St. Louis, who spent about $500,000 in exploration. The purchase price is said to have been about $300,000.

The property is now being entered by the Homestake company from its 2,300-foot level. It is supposed that the ore showing on the land is the southern extension of the Homestake body. Should the ore body prove present and of commercial grade at depth the life of the Homestake should be increased by very many years.

Calaveras Copper to Increase Plant

The Calaveras Copper Co., of Copperopolis, Calif., plans to enlarge its present plant, which consists of a flotation mill and smelter, to provide for an increased production of 50 percent over its present output. Plans are under consideration for the construction of a wire-drawing plant at Stockton, Calif. As the ore handled by the company contains practically no gold or silver, the copper produced can be refined at once and is then ready to be sold.

U. S. Smelting Sells California Property

The Hyman Michaels Co., of Chicago, has announced the purchase of the plant and equipment of the Mammoth, Keystone, and Kennett properties of the United States Smelting, Refining & Mining Co., Boston, these properties being located at Kennett, Calif. In addition to the plants, the purchase covers all personal properties, including a considerable amount of trackage and railroad equipment.

Nevada Mining Men Elect Officers

The 1925 officers of the Nevada Mine Operators' Association were reelected at the annual session of the members held in Reno recently. John G. Kirchen, president of the Tonopah Extension Mining Co., will lead the organization for the ensuing year; Arthur W. Lawry, of the Goldfield Consolidated, is first vice-president; and Clyde A. Heller, second vice-president. Henry M. Rives was reelected secretary and treasurer. Members of the executive committee also include Thomas C. Baker, J. W. Sherwin, H. A. Johnson, E. A. Julian, and W. S. Marsh.

A discussion of the silver question and the educational efforts of the United States Bureau of Mines in demonstrating mine-rescue work and theories in mine ventilation took place at the meeting. While no official action was taken, it was the sentiment of the meeting that the mine owners should cooperate with the Government whenever possible in the Bureau of Mines work.

Iron Cap Copper Wins Apex Suit

The United States Supreme Court has denied the appeal of the Arizona Commercial Mining Co. from the decision of a lower court which decided in favor of the Iron Cap Copper Co. This action brings to a conclusion one of the most important pieces of apex litigation that has ever been tried in the State of Arizona. Suit was originally instituted by the Arizona Commercial Mining Co. against the Iron Cap Copper Co. in the courts of Massachusetts and Maine to recover approximately $2,000,000 for ores alleged to have been taken from veins apexing in Arizona Commercial ground.

Consolidated Mining & Smelting's Capacity Greatly Increased

Plant extensions of the Consolidated Mining & Smelting Co. of Canada, Ltd., in 1925 were the largest in the company's history. Of most importance was the extension and realignment of the lead smelter at Trail, B. C., which raised the capacity to 350 tons, from 175 tons, daily. The zinc plant was enlarged to 200 tons, from 100 tons, capacity. Additions have been made to the silver refinery in order to keep pace with the treatment of lead and zinc ores, and provision has been made for recovering antimony, a new undertaking. The Trail concentrator, which is used largely in the treatment of custom ore, has been remodeled and enlarged to 325 tons, from 250 tons, daily capacity.

The American Mining Congress has just appointed a representative committee to study mining and loading problems in the coal-mining industry. The following gentlemen have been appointed to membership upon the committee:

MINING AND LOADING EQUIPMENT

Sub-committee No. 1—Loaders

T. E. Jenkins (chairman) Vice-Pres., West Kentucky Coal Co., Sturgis, Ky.
Newell G. Alford, Cons. Engr., Howard N. Eavenson & Associates, Union Trust Bldg., Pittsburgh, Pa.
Andrews Allen, Allen & Garcia Company, 21 E. Van Buren St., Chicago, Ill.
Frank E. Cash, United States Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
A. C. Green, Goodman Mfg. Co., Chicago, Ill.
G. W. Hay, Gen. Mgr., Consolidation Coal Co., Jenkins, Ky.
F. V. Hicks, Union Pacific Coal Company, Rock Springs, Wyo.
N. D. Levin, Jeffrey Mfg. Co., Columbus, Ohio.
Abner Lunsford, Gen. Mgr., Fordson Coal Co., Stone, Ky.
N. H. McClevey, Vice-Pres. and Gen. Mgr., Pike County Coal Corp., Petersburg, Ind.
J. D. A. Morrow, Joy Machine Company, Franklin, Pa.
Alex Palmros, Link-Belt Company, Philadelphia, Pa.
Richard Peale, Gen. Supt., Peale, Peacock & Kerr, St. Benedict, Pa.
Norton A. Newdick, The Coloder Company, Columbus, Ohio.
W. D. Turnbull, Westinghouse Elec. and Mfg. Co., E. Pittsburgh, Pa.
Wm. Whaley, Gen. Mgr. Myers-Whaley Co., Knoxville, Tenn.
L. E. Young, Gen. Mgr., Union Collieries Co., Duquoin, Ill.

Sub-committee No. 2—Conveyors

A. P. Cameron (chairman) Vice-Pres., Westmoreland Coal Co., Irwin, Pa.
C. H. Adamson, Stephens-Adamson Mfg. Co., Aurora, Ill.
W. L. Affelder, Asst. to Pres., Hillman Coal & Coke Co., First Nat'l Bank Bldg., Pittsburgh, Pa.
J. A. Appleton, Ironton Engine Co., Ironton, Ohio.
J. H. Beltz, Jeffrey Mfg. Co., Columbus, Ohio.
Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
T. W. Dawson, Chief Engr., H. C. Frick Coke Co., Scottdale, Pa.
Chas. Gottschalk, Cons. Engr., Evansville, Ind.
A. B. Jessup, Jeddo-Highland Coal Co., Jeddo, Pa.
Glen A. Knox, Supt., Gunn-Quealy Co., Gunn, Wyo.
E. F. Miller, Gen. Supt., Bertha-Consumers Co., Rachel, W. Va.
Edw. B. Raiguel, Cons. Engr., First Nat'l Bank Bldg., Huntington, W. Va.
D. A. Stout, Mgr., Fuel Dept., Colorado Fuel and Iron Co., Pueblo, Colo.
W. B. Turnbull, Westinghouse Elec. and Mfg. Co., E. Pittsburgh, Pa.
J. W. Wilson, Link-Belt Company, Philadelphia, Pa.
J. D. Zook, Vice-Pres., Illinois Coal Corp., Chicago, Ill.

Sub-committee No. 3—Methods of Mining With Mechanical Loading

G. B. Southward (chairman) Coal Service Corp., 2 Rector St., New York City.
A. R. Anderson, Jeffrey Mfg. Co., Columbus, Ohio.
W. A. Bishop, Chief Engr., Pocahontas Fuel Co., Pocahontas, Va.
D. J. Carroll, Chicago, Wilmington & Franklin Coal Co., Chicago, Ill.
Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
E. H. Coxe, Cons. Engr., Uniontown, Pa.
S. W. Farnham, Goodman Mfg. Co., Chicago, Ill.
H. S. Gay, G. M., Gay Coal and Coke Co., Mt. Gay, W. Va.
E. H. Johnson, The Coloder Company, Columbus, Ohio.
R. C. Lawery, Roberts and Schaefer Co., Chicago, Ill.
Rex Martin, Link-Belt Company, Chicago, Ill.
Erskine Ramsay, Cons. Engr., Birmingham, Ala.
Cecil W. Smith, Chief Engr., Illinois Coal Corp., Chicago, Ill.
Walter Stevens, Supt., Raleigh-Wyoming Coal Co., Glen Rogers, W. Va.
F. W. Whiteside, Chief Engr., Victor-American Fuel Co., Denver, Colo.
F. G. Wilcox, Pres., West End Coal Co., Mears Bldg., Scranton, Pa.

Subcommittee No. 4—Cutting Machines

Carl Scholz (chairman) Raleigh-Wyoming Coal Company, Charleston, W. Va.
E. K. Bowers, Asst. Treas., Morgan-Gardner Elec. Co., Chicago, Ill.
Walter Calverley, Pres., Fayette Coal Corp., Pittsburgh, Pa.
Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
J. M. Clark, Vice-Pres., Clark & Krebs, Inc., Charleston, W. Va.
R. L. Cox, Jeffrey Mfg. Co., Charleston, W. Va.
H. P. Dyer, Gen. Mgr., Vandalia Coal Co., Sullivan, Ind.
Wm. E. Hamilton, Mgr., Hamilton Engineering Co., Columbus, Ohio.
E. S. McKinley, Pres., McKinley Mining & Loading Machine Co., Pt. Pleasant, W. Va.
M. Mitchell, Sullivan Machinery Co., St. Louis, Mo.
C. W. Strickland, Gen. Mgr., Basic Coal Co., Huntington, W. Va.

The Cripple Creek Mine Owners' Association at its recent annual meeting re-elected Judge E. A. Colburn, of Denver, president; J. W. Ady, of Colorado Springs, vice-president; and W. A. Wanamaker, of Cripple Creek, secretary.

Lead and Zinc Merger

Consolidation of the Consolidated Lead & Zinc Co. and the Underwriters Land Co. was approved late in January at Joplin, Mo., by stockholders of the two companies. The properties merged are valued at more than $3,000,000 and consist of nine mills in the Picher, Okla., district, in addition to leases and royalty interests.

The company will be incorporated under the laws of Delaware. Directors elected include John B. Swift, president of the Eagle-Picher Lead Co., Cincinnati, and A. E. Bendelari, vice-president and treasurer of the Eagle-Picher, Chicago.

Hawthorne Mines Flotation Plant

After eight months of construction work, the 200-ton flotation mill of the Hawthorne Mines, Inc., Hawthorne, Nev., started crushing ore the first of February, and is working satisfactorily after some slight adjustments. The mill was designed and constructed by J. E. Rothwell, who will serve as superintendent. The crushing department is able to handle 400 tons in 16 hours, and foundations have been laid for another 200-ton unit. The machinery is operated by electric power.

Humboldt Smelter Resumes Operations

The Humboldt copper smelter of the Southwest Metals Co. at Mayer, Ariz., has resumed operations after a shutdown of two years. The Southwest Metals Co. is a reorganization of the old Consolidated Arizona Smelter Co. Owing to its location, the smelter was not able to compete with the older and larger establishments, with the result that when the metal slump came the Humboldt smelter was compelled to cease operations.

Montana Mine Tax Goes Uncontested

Montana's metal-mines license tax law, enacted by referendum at the November election in 1924, has gone uncontested in its first year of operation. Mining companies paid about $400,000, most of it under protest. The right of the companies to contest the law by suing the state for the return of these protested taxes expired on January 29, according to the deputy state treasurer.

Mason Valley Mines Company

George A. Kervin, until recently in charge of the Mammoth smelter of the United States Smelting, Refining & Mining Co., at Kennett, Calif., has been appointed general manager of the properties and smelter of the Mason Valley Mines Co., to succeed the late Emmet D. Boyle.

W. C. Plumb, formerly superintendent of mines for United States Smelting, has been named general superintendent of mines.

Ohio Operators Seek Betterment of Conditions in Their Industry

Representatives of all of the coal fields of Ohio met in Cleveland recently to discuss the coal situation, with a view to organizing for the purpose of promoting Ohio coals, especially since mining conditions have become so serious as to need all the business that can be secured. The meeting was called by the committee of the Pittsburgh Vein Operators' Association, which was appointed for that purpose. It is the hope of the committee that chambers of commerce will become interested in this matter and place it before the people in the light of favoring home industry. The Governor of Ohio is endeavoring to aid this movement through orders to the state institutions to use coal from their own state.

Northeast Kentucky Association Elects

At the annual meeting of the Northeast Kentucky Coal Association, held at Ashland, Ky., January 29, the following officers were elected: Henry Laviers, manager, Northeast Coal Co., Paintsville, Ky., president; Lew Roach, inspector of mines, Elkhorn Piney Coal Mining Co., Powellton, W. Va., first vice-president; T. T. Rogers, manager, Rogers Elkhorn Coal Co., Virgie, Ky., second vice-president; N. M. White, general manager, Colonial Coal & Coke Co., Prestonburg, Ky., treasurer.

Hard Coal Income Taxes Small

Out of 159 companies engaged in some branch of anthracite production only 26 made sufficient profits during 1924 to pay income taxes, according to information transmitted to the Senate by Secretary of the Treasury Mellon in response to the La Follette resolution. Twenty-seven of the companies, however, did not file a separate return because of affiliation with other corporations, those reporting net losses thus totaling 103.

The largest taxes were paid by the Glen Alden Coal Co., of Scranton, Pa., which paid $976,134, and the Lehigh Valley Coal Co., of Philadelphia, which paid $392,807. The Glen Alden Co. was granted a depletion allowance of $2,474,985 and a depreciation allowance of $1,118,994. Its net income was $7,809,069. The Lehigh Valley Co. was granted a depletion allowance of $1,249,338 and a depreciation allowance of $1,175,840. Its net income was $3,142,456.

Activities in the Iron Mining Country

Pickands, Mather & Co., large operators in the Lake Superior iron district, have awarded a contract to the Guthrie Co. to remove approximately 420,000 cubic yards of overburden from the lands recently taken under lease from the Volunteer Ore Co., near Palmer, on the Marquette range. A new open-pit mine will be getting out ore there next summer and will be operated by the Palmer Mining Co., a new subsidiary of Pickands, Mather.

The M. A. Hanna Co. is also to open a new pit mine at Palmer this year. This company's lease on the Richmond pit, owned by the Oliver Iron Mining Co., will expire at the end of 1926.

The Empire mine, which has been idle for several years, has been taken under lease by C. K. Quinn & Co.

Pig Iron and Steel Ingot Capacity

Some time ago a committee, headed by John A. Topping, was appointed by the American Iron & Steel Institute to determine the ingot capacity and the pig iron capacity of American furnaces. This committee has placed the practical steel ingot capacity at 50,000,000 gross tons annually and the theoretical capacity at 56,000,000 gross tons. Practical pig iron capacity is placed at 45,000,000 gross tons annually with theoretical capacity at 50,500,000 gross tons. Thus, pig iron production in 1925 was 36,403,740 gross tons, or about 72 percent of theoretical capacity and 80.8 percent of practical capacity. In the same way steel ingot production of 44,186,977 gross tons was at 88.3 percent of practical capacity and 78.9 percent of theoretical capacity.

Pig iron furnaces in blast at the beginning of 1926 had a daily capacity of 107,560 gross tons. At the beginning of 1925 the daily capacity of furnaces in blast was 98,380 gross tons and at the beginning of 1924 was 94,265 gross tons. The furnaces in blast on January 1, 1923, had a daily capacity of 101,400 gross tons. In the year 1923 there was produced 40,000,000 gross tons of pig iron. The higher capacity of the furnaces in blast at the beginning of this year is said not to necessarily indicate that the pig iron tonnage for this year will exceed that of 1923, but it does show that pig iron producers are expecting a year of high production.

James Aston Named Head of Department of Mining and Metallurgy, of Carnegie Institute

James Aston, of Pittsburgh, for the past five years metallurgical engineer in charge of research with the A. M. Byers Co., has been appointed professor of mining and metallurgy and head of the Department of Mining and Metallurgical Engineering of Carnegie Institute of Technology. Announcement of the appointment was made by President Thomas S. Baker, January 26, at the meeting of Metallurgical Advisory Board held at the Pittsburgh station of the United States Bureau of Mines in connection with the formal opening of the new ferro-metallurgical research laboratories.

The appointment, which was effective February 1, fills the vacancy caused by the death last February of Prof. Fred Crabtree. Prof. F. F. McIntosh, who has been in charge of the department as acting head since Professor Crabtree's death, it was also announced, has resigned, effective February 1, to accept an important position with the Crucible Steel Co.

Mr. Aston served as a member of the Advisory Board of prominent representatives of the metallurgical industries of the Pittsburgh district, which cooperates with the Carnegie Institute of Technology and the Bureau of Mines in conducting research in metallurgy.

Potash Deposits of Southwest May Take Market Control From Germany

Promising sources of potash in the salt beds of western Texas and southeastern New Mexico have been discovered that may check the domination of the potash market in the United States by foreign producers, according to a Geological Survey report.

The report shows that these beds are likely to be thick and extensive, suggesting large potash salt deposits, and while the samples obtained have not shown conclusively whether the potash is present in commercial quantity, indications point in that direction. The discovery was made through the drilling for oil in these regions where the cuttings have revealed potash salts such as are found in Germany and France.

Potash is required especially in the raising of cotton, tobacco, potatoes, and garden truck, as well as in certain chemical industries, some of which are essential to the national defense. The report points out that at the present time German and French potash producers enjoy a virtual monopoly of the American market. In August, 1924, the producers of these two countries signed an agreement concerning sales of their potash in the United States and now supply directly or indirectly 90 percent or more of the potash sold here.

Geo. M. Hunt to Make Survey of European Timber Preservation Methods

George M. Hunt, head of the wood-preservation section of the United States Forest Products Laboratory, Madison, Wis., will sail for England early in March to make a survey of European wood-preserving methods and to collect European service records on chemically treated railroad ties, mine timbers, posts, and poles. He expects to visit England, Belgium, France, Italy, Switzerland, Austria, Hungary, Czechoslovakia, Germany, Denmark, Sweden, Norway, Hol-

land, and possibly other countries. The entire trip will require about five months.

The Forest Products Laboratory is particularly interested in discovering the merits of a number of new wood preservatives recently developed in Europe, some of which are now being promoted in this country. Mr. Hunt will investigate these newer preservatives as well as the methods used for impregnating wood with creosote, zinc chloride, and other standard preservatives. According to Mr. Hunt, the length of time treated timbers will resist decay in actual use is still the only reliable test of a preservative. The records which the Forest Products Laboratory, in cooperation with timber users, has collected on treated wood in service in the United States probably constitute the largest collection of the kind in the world, but their value will be greatly enhanced by the addition of European service data, which Mr. Hunt hopes to obtain in exchange from many of the countries to be visited.

In addition to the wood-preservation studies, Mr. Hunt will study the progress of forest products research abroad, visiting in particular the newly established Forest Products Research Laboratory of England. In Switzerland he will investigate the Hetzer system for forming large timbers by gluing boards together.

Mr. Hunt will arrive in Italy late in April and will attend the World's Forestry Congress, which the Italian Government has invited to assemble in Rome April 29 to May 5.

Eagle-Picher Purchases Lead Leases

The Eagle-Picher Lead Co. has purchased an operating option on the mill and 473 acres of leases in the Waco, Mo., section of the Joplin-Miami district, owned by Frank Childress and C. Bai Lihme, of Chicago, for a consideration said to be close to $300,000. The Eagle-Picher Co. intends to drill the property, enlarge the mill, and increase production.

Annapolis Lead Company to Reorganize

The Annapolis Lead Co., which suffered heavy damages to its property when the tornado of March 18 last struck the town of Annapolis, Mo., will be reorganized and will begin operations very shortly, President M. C. Rhodes has announced. A foreclosure suit against the company, which is capitalized for $2,500,000, will be dismissed by the bondholders who instituted it, Mr. Rhodes said.

1926 First Aid Meet

The International First Aid and Mine Rescue Meet of 1926 will be held this fall in San Francisco. Word has been received by Bureau of Mines officials from the Safety Engineers of California, guaranteeing the expenses of the event up to $4,500. It is possible that a similar meet will be staged at the Philadelphia exposition by the Bethlehem Steel Corporation.

Pittsburgh Coal Opens Eighth Mine

The Pittsburgh Coal Company started work late in February at its Euclid Mine, four miles from West Newton, as the eighth mine of the company in the Pittsburgh district to resume operations at the November 1917 wage scale.

Fifty-seven men went to work at the Euclid mine. This makes a total of more than 1,700 men working for the company in the Pittsburgh district at the 1917 scale.

West Kentucky Coal Merger

A group of coal operations in western Kentucky, in which the Monroe Warrior Coal & Coke Co., of Birmingham, Ala., is said to be financially interested, are included in a merger which will bring them all into one $5,250,000 company. The group represents the first strip operations in the state.

Included in the merger will be the Western Collieries Co.; Magic Colleries Co., both near Dawson Springs; Ilsley Mining Co., Ilsley; a subsidiary of the Norton Coal Mining Co., Sunlight Mining Co., near Madisonville, the first strip operation in the state; all of the above being strip mines; the Norton Coal Mining Co., Nortonville; and the Empire Coal Co., near Madisonville, both underground mines.

A holding company is to be organized under the laws of Delaware, and the separate corporations all brought into one company.

The interests behind the merger are said to be planning the installation of a million-dollar power plant at Norton, Ky., furnishing such power as needed in company operations, and selling the rest to the larger power companies, or nearby towns.

The company, according to Monroe B. Lanies, of Birmingham, will be the Kentucky Consolidated Power & Utilities Co., or holding company for the various mines and the proposed power plant. It was stated that extensive improvements are contemplated at several of the mines involved.

Pennsylvania Geological Survey Issues Bulletin On Anthracite

According to a bulletin issued by the Pennsylvania Geological Survey, there are 16,354,676,000 tons of anthracite remaining in the ground and of this quantity 8,979,474,000 tons are recoverable. The Northern field is estimated to have a life of 50 years, the Eastern middle field, 35 years, the Western field, 100 years, and the Southern field, 110 years.

In a summary of the bulletin, Dr. George H. Ashley says: "It is about 30 years since a State commission studied the mining of anthracite with reference to its recovery and the waste of coal. Their report showed that at that time the recovery averaged 41.5 percent of the coal in the ground, or, omitting certain collieries in the Southern field, one of which reached a recovery of 51.5 percent, the average of the rest was only 38.5 percent of the coal originally below the surface. This new publication indicates that the recovery in the anthracite fields in 1921 averaged 61.1 percent with a total loss of 38.9 percent, of which 4.3 percent is in preparation. This indicates clearly that mining and preparation methods in the anthracite regions are improving rapidly."

Will Add 300 Ovens to Clairton Coke Plant

The Carnegie Steel Co. is planning to add 300 ovens to the Clairton by-product coke plant. The projected improvements will involve an outlay of between $3,000,000 and $4,000,000, it is said. Work will probably be started in the spring. The additions will give the plant a total of 1,434 ovens.

"The Story of Rock Dusting"

A two-reel moving picture, captioned "The Story of Rock Dusting," will be made and distributed by the U. S. Bureau of Mines. The film will graphically portray the manner in which this safety method saved the lives of 1,055 miners in the explosion which occurred recently in the New Orient mine of the Chicago, Wilmington & Franklin Coal Co., according to word received by Director Turner, of the Bureau of Mines, from George B. Harrington, president of the company.

Magma Copper Improvements

An improvement program totaling $500,000, including the sinking of a new 2,500-foot shaft and the construction of an electrically operated tramway, has been announced by the Magma Copper Co., of Superior, Ariz. The new shaft will have four or five compartments and is to be sunk primarily for ventilation, although it will be equipped for hoisting rock. The work of grading for the surface tramway has already started and the construction of the new shaft will be begun shortly.

According to the annual report of T. C. Foster, state mine inspector, there are 125 operating mines in the State of Arizona mining copper, gold, and silver and other ores. More than 13,985 men are employed. Of this number 4,147 are employed as surface workers and 9,838 are underground workers.

Treating Low-Grade Phosphate

A new process for treating economically low-grade phosphate for the production of 30 percent acid phosphate is claimed by a French mining engineer. It is proposed to treat North African ore of a grade lower than 58 percent tricalcium phosphate and produce therefrom high-grade acid phosphates.

Would Have Realtors Handle Mining Property

A movement has been launched by the Department of Mines and Mining of the Sacramento Chamber of Commerce to have realtors of California list and handle mineral deposits and mining properties of merit, the same as other industrial properties and plants. It is claimed by the department that this will result in much greater mineral activity, particularly in the development and utilization of nonmetallics and industrial metals, as it will make such properties easy of access to the industries desiring such raw materials.

Coal Mining Leases and Royalties

A study of coal-mining royalties and leasing conditions in Williamson and Franklin Counties, Ill., conducted by the Bureau of Mines, shows that, since 1900, in Williamson County, the average royalty has gradually increased from about 3 cents per ton for run-of-mine coal to about 6½ cents. In Franklin County during the same period it has risen from 1½ cents per ton to 5 cents per ton.

In normal periods in the coal mining industry a tract of coal land in Williamson County brings about 8 cents per ton royalty. This presupposes that all conditions as to mining, shipping and quality are favorable and that it will be mined in the course of the normal development of the field. In Franklin County the probabilities are that a slightly less royalty would be asked than in Williamson, although royalties as high as 10 cents per ton have been received.

There are no recent figures at hand of royalties in other coal fields of the country. But contrasting the average royalty of this district for recent years with those in other coal fields as obtained in a study made by the United States Geological Survey in 1910, it would appear that southern Illinois coal is valued at a much lower figure in comparison.

As far back as 1910 Pittsburgh coal royalties ranged from 10 to 15 cents per ton of run-of-mine coal. Hocking Valley, Ohio, coal brought 8 cents per ton; Kanawha, W. Va., 5½ cents to 10 cents; Routt County, Colo., 8 cents to 10 cents; Boulder County, Colo., 8 cents to 27½ cents. These figures of 16 years ago are higher than the Williamson County average of a little over 6 cents per ton or the Franklin County average of from about 4 to 7 cents per ton for the past few years.

Minimum royalties are usual in nearly all leases and are ordinarily stated in the number of tons which must be mined per month.

There does not seem to be any definite reason for the seeming discrepancy in values between the southern Illinois coals and those mined in other fields, the Bureau of Mines points out. The Pittsburgh and West Virginia coals, in the past, have been considered superior coals for metallurgical purposes and have established a reputation not yet enjoyed by Illinois coals. This may have brought a steadier market for those coals and hence increased their value. The market for Illinois coal is largely domestic, therefore more or less seasonable.

Whether or not the value of the surface for agricultural purposes and its general flatness has a tendency to keep the value low is problematical. The fact that only a fair recovery of coal, due to this and other causes, is obtained seems to be partly a consequence of the low coal value.

The highest price of District VI No. 6 coal and surface noted by the Bureau of Mines is $125 per acre for coal and $75 per acre for surface, a total of $200 per acre. The average thickness of coal bed is given as 9.2 feet and the average thickness actually mined is given as 7½ feet. These figures will give an approximate acre-foot value of $21.50 and $26 respectively, the latter figure being the most favorable figure possible for coal values.

Comparing the United States Geological Survey maximum acre-foot values of 15 years ago; Pittsburgh coal is $110 to $170; Kanawha District $6 to $60; Pocohontas District, W. Va., $10 to $40; Colorado, $23 to $60. And probably in none of these places does the surface value play as large a part as in the Illinois acre-foot values.

In Illinois there are about 13,275 acre tons, if the average mined thickness is taken as 7.5 feet. At a royalty of 5 cents, the royalty value of an acre would be about $800. The selling price of this coal, without surface, averages $125 an acre.

One of the factors affecting values of coal lands, hence the royalty rate, is competition from other fields and freight rates. At the present time Illinois fields are feeling the effect of the competition from southern coal-producing territory.

As opportunity affords, similar studies of coal-mining royalties and leasing conditions will be conducted by the Bureau of Mines in other states. It is hoped that the data obtained will assist the coal-mining industry to standardize the forms of leases, and so avoid some of the abstruse and ambiguous clauses which may be found in many of them and the consequent liability of costly litigation.

The report of the present study, made by L. D. Tracy, coal-mining engineer, includes a short description of the geological conditions, the character and quality of the coal and the nature of the surface. Mining methods and percentages of recovery are mentioned, together with physical conditions, market and transportation facilities.

Copies of Serial 2726, "Coal-Mining Royalties and Leasing Conditions in Williamson and Franklin Counties, Ill. (District No. VI)," may be obtained from the Bureau of Mines, Department of Commerce, Washington, D. C.

THE NATION'S VIEWPOINT

(*Continued from page* 227)

"There have also been cases in which mining claims were staked out by individuals for the sole purpose of selling out to timber, live stock, power or irrigation interests.

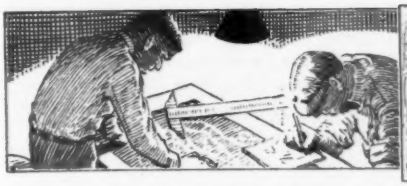
"But homesteads and desert land entries have been taken out in the same way, and doubtless the fake homesteads would outnumber the false mining claims 100 to 1.

"Admitting that there have been fraudulent mining claims, the fact remains that the practice is relatively rare. And there are ways of punishing fraud without retarding an entire industry.

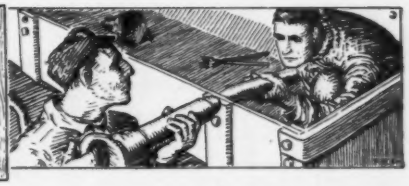
"How about abuses in the forest reserves, about which Secretaries Work and Jardine profess to be greatly concerned? Any mining man will agree that the abuses are generally on the side of the Forest Service, which has a policy of harassing the mining men.

"A third of the state of Idaho is embraced within the boundaries of national forests, and Idaho is not an extreme example among western states. The measure which Jardine and Work have proposed would stop prospecting within forest reserves, for the restrictions would prevent the development and exploitation of a valuable mineral discovery if made.

"Mining is one of the greatest industries in Idaho, and mineral is its greatest potential resource. The Federal Government through the forestry system has already robbed the state of its great timber resources and now it is proposed to take its mineral resources also, or at least block their discovery and development."



WITH THE MANUFACTURERS



The General Electric Co. has designed and is now marketing a new line of synchronous motors for general purpose application. These motors are recommended to drive any load whose torque requirements have been heretofore met with a standard squirrel cage induction motor. The new motors are of the G. E. types TS and QS and are known as the 7500 series.

These motors meet all the Electric Power Club requirements for a general purpose motor; give satisfactory starting characteristics; are of strong construction, and with minor changes will operate at unity 90 percent or 80 percent power factor. The ratings range from 20 to 150 horsepower, with speeds of 1,200, 900, 720, and 600 revolutions per minute at 60 cycles. The motors are rated at 40 degrees continuous at unity power factor. At 90 percent or 80 percent power factor, the temperature of the stator will not exceed 40 degrees, with 50 degrees on the rotor.

Adequate starting torque is the most important feature in the design of the new motors, each motor being guaranteed to deliver the same starting torque with the same inrush current as the standard squirrel cage induction motor of similar rating. At full line voltage the motor will accelerate and synchronize a load whose torque is 100 percent of the rated full load torque of the motor.

The motors are of the revolving field, salient pole type, and are separately excited, usually by means of direct connected exciters. One of the principal advantages is in the amortisseur windings, so designed as not to be a limiting feature in regard to heating. These starting windings will not become dangerously heated before the primary motor coils are overheated. Thus adequate overload protection in the alternating-current lines will also protect the amortisseur windings from overheating resulting from failure to start, or because of operation without exictation.

With these motors, semiautomatic control is recommended, by means of which the field excitation is automatically applied. The motor is started by means of a manually operated, self contained compensator. The operations required to start are, therefore, identical with the starting of a squirrel cage induction motor.

Ohio Brass Develops "Flecto" Iron

The Ohio Brass Co., Mansfield, Ohio, has developed a new metal which it has called "Flecto" iron. This is a type of malleable iron which, by virtue of a heat-treating process, is freed from all tendency toward embrittlement when hot-dip galvanized. While retaining all of the desirable characteristics of malleable iron, the Flecto process so improves the metal with added valuable properties that it is considered to be practically a new metal.

This announcement is made only now, but it is understood that all malleable-iron castings produced by this manufacturer during the past two years have been treated by this process, the company having withheld announcement until the metallurgy of this new metal had been thoroughly proved by its use in the field.

The most valuable characteristic of the new iron is that it withstands galvanizing by the hot-dip method without any tendency to become brittle. Hot-dip galvanizing has long since been recognized as the best method of rust-proofing castings. However, ordinary malleable castings are very frequently embrittled by galvanizing. As a result, many substitute methods of rust-proofing have been resorted to, but experience has shown the great desirability of hot-dip galvanizing if the bad effect upon the iron could be overcome. This has now been accomplished in this new iron whose main characteristic is that it always retains its malleable properties. In fact, treatment of castings by this process so improves the properties of the metal that all castings of the Ohio Brass Co. are being treated by this process, whether hot-dip galvanized or not.

The process for making Flecto iron is patented, but is available to other manufacturers under a very liberal license arrangement.

New Westinghouse Panelboard for Industrial Use

A new line of industrial panelboards for the control of lighting systems in offices and factories has recently been announced by the Westinghouse Electric & Manufacturing Co. These panelboards are made in sizes supplying from 4 to 32 circuits and in capacities ranging from 30 to 100 amperes.

The new panelboards are constructed with two doors, one within the other. The smaller door, giving access to the switch compartment; has a snap catch and may be opened by anyone. The larger door, opening into the fuses, is equipped with a Yale lock so that only authorized persons may open it. Such construction insures absolute safety to employes operating the panelboard.

Both the types of panelboards are built up in unit construction, with eight single pole or double pole switches. When single pole switches are used the switch unit consists of two single pole switches built on a composition base. With double pole switches unit consists of one double pole switch on a base of the same material. These units may be easily removed from the front of the panelboard, making inspection and replacement easy.

The cabinet fronts of these panelboards are equipped with the Westinghouse standard trim clamp for mounting the trim on the box. This clamp permits easy adjustment of the panelboard trim when the box has been set up out of plumb. The trim clamp allows an adjustment up to three-fourths of an inch in depth and a lateral adjustment of 3.4 of an inch.

Westinghouse publication DMF M-314 describes these panelboards in detail and lists complete ratings and capacities. The publication will be supplied upon request to any Westinghouse office.

The John H. McGowan Co., Cincinnati, Ohio, announces the purchase of the Twinvolute Pump Mfg. Co., of Newark, N. J., builder of centrifugal pumps. The line consists of side suction, horizontally split-case, double-suction, single and multi-stage pumps, made in either belt or motor-driven types. Capacities range from 5 to 125 gallons per minute, heads up to 70 feet for the side-suction pumps. In the horizontally split-case design they have a range of capacity from 30 to 2,100 gallons per minute for heads up to 230 feet for single stage, and higher heads in the multi-stage patterns. Automatic sump pumps, also pumps and receivers of various sizes in addition to the above, will be manufactured in the works at Cincinnati. The product has been carefully designed with the thought of producing an efficient pump, and one that is readily accessible, and constructed so that the wearing parts can be readily and inexpensively replaced, maintaining the efficiency.

The Dreses Machine Tool Co., Cincinnati, has awarded a contract for an entirely new plant to cost $100,000. The Austin Co., Cleveland, is the engineer and builder. The new Dreses plant will be of one-story design, 90 by 300 feet, with monitor. About 100 tons of structural steel will be required. Cranes will be installed, two 5-ton cranes in the center aisle and one 3-ton crane in the side aisle. The Austin Co. contract included heating, lighting, plumbing, and erection of cranes, in addition to construction. Chas. E. Gilbert is president and W. A. Hudson secretary and treasurer of the Dreses Co. Mr. Gilbert is also interested in the Buckeye Foundry Co., of Cincinnati.

Allis-Chalmers business in Continental Europe will be handled through an organization recently incorporated as Allis-Chalmers (France), with headquarters at 3 rue Taitbout, Paris. H. I. Keen, who has been manager of European sales through the company's district office in Paris, will be the managing director of the new organization.

The company has maintained for many years an office in London, 728 Salisbury House, London Wall, F. C. 2.

Robert J. Beler has recently joined the Pittsburgh sales office of Foote Bros. Gear & Machine Co. as assistant to Mr. W. G. Kerr, district representative.

Brooklyn Edison Co. Extends Its Generating Station

The Brooklyn Edison Co. has just purchased from the Westinghouse Electric & Manufacturing Co., for the fourth extension of their Hudson Avenue generating station, underfeed stoker equipment capable of producing 500 percent rating continuously.

General Electric Supplementary Compensation

Supplementary compensation, amounting to $1,367,426.07, was paid in February by the General Electric Co. to 30,813 employes of its plants and offices who have been with the company for five years or more. The sum paid each individual represents 5 percent of his earnings for the six months ending December 31, 1925. Payments were made in G-E Employes' Securities Corporation bonds or cash, as the employes desired. Both the amount paid and the number of employes benefiting by this plan exceed those of June, 1925.

The Timken Roller Bearing Co. has promoted R. Chas. Brower to the position of assistant to H. J. Porter, vice-president in charge of sales. Mr. Brower first became associated with the Timken Co. in 1916, as district manager of the Bearings Service Co., with offices in Detroit. At the dissolution of this company in 1922, the Timken Roller Bearing Service & Sales Co. was organized. He then came to Canton, the headquarters of the new company, as assistant general manager, which position he has held until his present promotion. The present offices will be maintained at Canton.

E. D. Dickinson, General Electric Co., recently presented a paper on "Utilization of Extraction Steam," before the Affiliated Technical Societies of Boston, which created an unusual amount of discussion. As the subject is a very live one, the company has prepared mimeograph copies for distribution, which may be obtained by addressing the Home Office at Schenectady.

H. H. Snell, formerly manager of the Gear Department for Chas. Bond Co., Philadelphia, has recently been appointed as district representative for Foote Bros. Gear & Machine Co., of Chicago. His territory covers eastern Pennsylvania, Delaware, Maryland, and the southern half of New Jersey. Chas. Bond Co., former representatives for Foote Bros. Gear & Machine Co., will still continue to handle the IXL line as jobbers.

A. H. Tischer has recently joined the engineering force of the Foote Bros. Gear & Machine Co., of Chicago, as designing engineer.

H. S. Durant has been appointed manager of the Cold Rolled Strip and Spring Sales Department, Chicago, vice Mr. Lewis Johnson, deceased.

Carter Miller, advertising manager of the Timken Roller Bearing Co., died January 11, 1926, after a brief illness of a few days with pleuro-pneumonia.

New Sullivan Literature

"Speed Up With Air," 16 pages, road builders' and contractors' booklet, illustrating Sullivan portable air compressors, and many applications of Sullivan rotator hammer drills, clay spaders, concrete breakers, portable hoists, etc. Tables of capacities and specifications are given.

Bulletin 81-I, 12 pages, Sullivan concrete breakers, featuring two new types, DW-221, 75 pounds heavy-duty buster, and 48 pounds DP-221 light buster, for concrete breaking in street opening, demolition work of many kinds, etc. The term "Buster" has just been registered as a trade-mark to designate this type of tool.

Bulletin 81-J, Sullivan Clay Spader, eight pages, shows a number of interesting pictures of this useful type of compressed-air tool at work.

Bulletin 72-I, Sullivan Class C All Hammer Light Sharpener. This compressed-air machine for making drill bits and shanks, concrete breaker tools, etc., weighs only 1,100 pounds and takes only about 15 percent as much compressed air as the previous type, but will make bits on ⅞ or 1-inch steel up to 2½-inch gauge, rapidly and perfectly.

Bulletin 81-H, JC Automatic Line Oiler for Rock Drills and Hammer Drills, secures effective and continuous lubrication while the drill is at work.

Bulletin 74-B describes the Sullivan standard oil and gas drill steel heating furnace, including mention of the magnetic indicator for determining the critical point in heating steel for tempering.

Bulletin 83-B, new edition describing Sullivan single-stage belt-driven air compressors, Class WG-6.

Bulletin 81-K, new edition, describing Sullivan plug drills for granite quarries.

Foote Bros. Gear & Machine Co. have recently published a new edition of their IXL Speed Reducer Book, which is said to give a great deal of interesting engineering information in regard to the application of spur and worm gear speed reducers to all forms of industrial equipment. Copies may be had upon application to their home office, 215 North Curtis Street, Chicago.

The February issue of the General Electric Review, published by the General Electric Co., Schenectady, N. Y., carries a very interesting article by W. B. Snyder, of their Industrial Engineering Department, on "Synchronous Converters and Synchronous Motor Generators Compared for Industrial Service."

The Alexander Milburn Co., Baltimore, Md., has just issued a new catalog dealing with Milburn cutting and welding torches. Copies will be furnished upon request.

Du Pont Explosive Service Bulletin for January, 1926, carries an interesting article by C. H. Coale, sales representative of the company, on Storage of High Explosives.

ADMIRALTY
New River Smokeless

Admiralty Coal
New River Smokeless

Prepared over Shaker Screens and Loading Booms
Highest Standards of Preparation
LUMP EGG NUT

DEPENDABLE COAL
Anthracite

GENERAL COAL COMPANY
1727 Land Title Building
PHILADELPHIA

BUNKER COAL
Supplied at
Baltimore, Md.
Charleston, S. C.
Hampton Roads, Va.
Jacksonville, Fla.
New York
Philadelphia
Savannah, Ga.

BOSTON
CHARLESTON
CHARLOTTE
CINCINNATI

EXCLUSIVE SALES AGENT
—FOR—
STONEGA COKE AND COAL CO.
HAZLE BROOK COAL CO.
—AND—
SUCCESSOR TO BUSINESS OF
WENTZ COMPANY
—ALSO—
EXCLUSIVE WESTERN SALES AGENT
—FOR—
WESTMORELAND COAL CO.

DETROIT
NEW YORK
NORFOLK
PITTSBURGH

EXPORT & COASTWISE COAL
Loaded at
Baltimore, Md.
Charleston, S. C.
Hampton Roads, Va.
Philadelphia

THORNE, NEALE & COMPANY., Inc.
FRANKLIN BANK BUILDING
1416 CHESTNUT STREET—9 A. M. to 4 P. M.
PHILADELPHIA, PA.

MINERS' AGENTS AND WHOLESALE DEALERS

Anthracite ***COAL*** ***Bituminous***

ANTHRACITE COLLIERIES

Mt. Lookout, Sterrick Creek, Harry E, Northwest, Forty Fort, Lackawanna, New Castle, Buck Run, Locust Run (Washery)

Pardee Bros. & Co.—Lattimer Lehigh

BITUMINOUS

Sonman, South Fork District—Low volatile, low ash, low sulphur

Smithing—1 1-4 in. screened

Fairmont — Quemahoning — Indiana County

NEW YORK OFFICE: 17 BATTERY PLACE

Branch Offices: Baltimore Buffalo Chicago Scranton, Pa Mauch Chunk, Pa.

BUYER'S DIRECTORY

ACETYLENE, Dissolved (Or in Cylinders)
Prest-O-Lite Co., Inc., 30 E. 42nd St., N. Y. C.

ACETYLENE GAS
Prest-O-Lite Co., 30 East 42nd St., New York City.

ACETYLENE GENERATING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

ACID, SULPHURIC
Irvington Smelting & Refining Works, Irvington, N. J.

AERIAL TRAMWAYS
American Steel & Wire Co., Chicago and New York.

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

AUTOMATIC CAR CAGES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

AUTOMATIC FEEDERS, GRAVITY
G. M. Johnson Mfg. Co., Jeannette, Pa.

AUTOMATIC (Mine Doors, Truck and Electric Switches)
American Mine Door Co., Canton, Ohio.

AUTOMATIC SWITCH THROWERS
G. M. Johnson Mfg. Co., Jeannette, Pa.

BATTERIES (Storage, Gas Welding, Cutting, Dissolved Acetylene)
Prest-O-Lite Co., 30 East 42nd St., New York City.

BATTERY SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

BEARINGS (Roller)
Hyatt Roller Bearing Co., Harrison, N. J.

BELTING (Conveyor, Elevator, Transmission)
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

BELTING, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

BINS (Coke and Coal)
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

BIT SHARPENERS
Ingersoll-Rand Co., 11 Broadway, New York City.

BLACK DIAMONDS
R. S. Patrick, Sellwood Building, Duluth, Minn.

BLASTING POWDER
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

BLASTING SUPPLIES
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

BLOWERS, CENTRIFUGAL
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

BLOWPIPES, Brazing, Carbon Burning, Cutting, Lead Burning, Welding, Welding and Cutting
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

BREAKERS (Construction and Machinery)
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

BUCKETS (Elevator)
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CABLES
American Steel & Wire Co., Chicago and New York.

CABLES (Connectors and Guides)
American Mine Door Co., Canton, Ohio.

CABLEWAYS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

CAGE (Safety Appliances)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

CAGERS, AUTOMATIC
G. M. Johnson Mfg. Co., Jeannette, Pa.

CAGES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
G. M. Johnson Mfg. Co., Jeannette, Pa.

CARBON AND BORTZ
R. S. Patrick, Sellwood Building, Duluth, Minn.

CARBON BURNING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

CARBON RODS AND PASTE FOR WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

CAR HAULS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus. O
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CAR WHEEL BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

CASTINGS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CHAIN RAIL CAR HAULS
G. M. Johnson Mfg. Co., Jeannette, Pa.

CHAINS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CHAINS, AUTOMOBILE ENGINE
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, COAL CUTTING
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CHAINS, DRIVE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, FRONT END
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, OILING
Morse Chain Co., Ithaca, N. Y.

CHAINS, POWER TRANSMISSION
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CHAINS, SILENT (Rocker-Joint)
Morse Chain Co., Ithaca, N. Y.

CHAINS, SLING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

CHAINS, SPROCKET WHEEL
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CHILI MILL SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

CLAMPS (Trolley)
Ohio Brass Co., Mansfield, Ohio.

CLUTCHES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL COMPANIES
General Coal Company, Land Title Bldg., Philadelphia, Pa.
Lehigh Coal & Navigation Co., Philadelphia, Pa.
Thorne, Neale & Co., Philadelphia, Pa.
Bertha-Consumers Company, Chamber of Commerce Bldg., Pittsburgh, Pa.

COAL CRUSHERS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL CUTTERS
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL HANDLING MACHINERY
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL LOADERS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL MINING MACHINERY
Goodman Mfg Co., Halsted St. and 48th Pl., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

COAL MINING PLANTS
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

COAL SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

COKE SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

COMPRESSORS, AIR
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

COMPRESSORS, MINE CAR
Ingersoll-Rand Co., 11 Broadway, New York City.

CONCENTRATORS (Table)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CONCRETE REINFORCEMENT
American Steel & Wire Co., Chicago and New York

CONDENSERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

CONTROLLERS
Goodman Mfg. Co., Halsted St. and 48th Place, Chicago, Ill.

Your source of dissolved acetylene becomes not one source but 102 if you use

Prest-O-Lite
DISSOLVED ACETYLENE

THE PREST-O-LITE COMPANY, INC.
Oxy-Acetylene Division

General Offices: Carbide and Carbon Bldg., 30 East 42d St., New York
In Canada: Prest-O-Lite Co. of Canada, Limited, Toronto

31 Plants—71 Warehouses—22 District Sales Offices

A Prest-O-Lite PRODUCT
WORLD'S LARGEST MANUFACTURER OF ACETYLENE THE GAS OF A THOUSAND USES
BATTERIES FOR AUTOMOBILES FARM LIGHTING RAILWAY SIGNALS AND RADIO

CONVERTORS, COPPER
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Traylor Engineering & Mfg. Co., Allentown, Pa.

CONVEYOR BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

CONVEYORS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, BELT
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CONVEYORS, CHAIN FLIGHT
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CONVEYORS, COAL
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CONVEYORS AND ELEVATORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CONVEYORS, PAN OR APRON
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CONVEYORS, SCREW
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CORE DRILLING
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa

COUPLINGS, FLEXIBLE
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

CROSSINGS AND CROSSOVERS
Central Frog & Switch Co., Cincinnati, Ohio.

CRUSHER SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

CRUSHERS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CRUSHERS, COAL
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

CRUSHERS, SINGLE & DOUBLE ROLL
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CRUSHING PLANTS, COKE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

CUTTING APPARATUS, Oxy-Acetylene, Oxy-Hydrogen
Oxweld Acetylene Co., 30 E. 42nd St., New York City.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

DECARBONIZING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

DESIGNERS OF PLANTS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DIAMOND CORE DRILL CONTRACTING
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa

DIAMOND DRILLING CARBON
R. S. Patrick, Sellwood Building, Duluth, Minn.

DIAMONDS, BLACK (See Carbon and Bortz)
R. S. Patrick, Sellwood Building, Duluth, Minn.

DOORS, AUTOMATIC MINE
American Mine Door Co., Canton, Ohio.

DOUBLE CRIMPED WIRE SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

DRIFTERS, DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLING, DIAMONDS FOR
R. S. Patrick, Sellwood Building, Duluth, Minn.

DRILLS, AIR AND STEAM
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS (Blast Hole)
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS, CORE
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.

DRILLS, ELECTRIC
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

DRILLS, HAMMER
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS (Hand Operated Coal)
Ohio Brass Co., Mansfield, Ohio.

DRILLS, PNEUMATIC
Ingersoll-Rand Co., 11 Broadway, New York City.

DRILLS, PROSPECTING
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa
Ingersoll-Rand Co., 11 Broadway, New York City.
Keystone Churn Drill Co., Beaver Falls, Pa.

DRILLS, ROCK
Diamond Machine Co., Monongahela, Pa.
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

DRILL STEEL SHARPENERS
Ingersoll-Rand Co., 11 Broadway, New York City.

DRIVES, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

DRUMS (Hoisting, Haulage)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

DUMP CARS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

DYNAMITE
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

DYNAMOS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.

ELECTRICAL APPARATUS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

ELECTRIC HOISTING MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

ELECTRIC LOCOMOTIVES
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Ohio Brass Co., Mansfield, Ohio.

ELECTRIC MINE SUPPLIES
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

ELECTRIC WIRES AND CABLES
American Steel & Wire Co., Chicago and New York.

ELECTRICAL SUPPLIES
General Electric Co., Schenectady, N. Y.

ELEVATORS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

ELEVATORS, BUCKET
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

ELEVATOR MACHINERY
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

ENGINES, GAS AND GASOLINE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.

ENGINES (Hoisting and Hauling)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

ENGINES, OIL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway New York City.

ENGINES, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway New York City.

ENGINEERS
H. R. Ameling Prospecting Co., Rolla, Mo.

EXPLOSIVES
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., 934 King St. Wilmington, Del.

FAN DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

FANS, VENTILATING
Connellsville Mfg. & Mine Supp. Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

FEEDERS, ORE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

FILTER WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

FLOTATION MACHINES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FLOTATION OILS
Hercules Powder Co., 934 King St., Wilmington, Del.

FLOW METERS
General Electric Co., Schenectady, N. Y.

FLUX, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

FORGINGS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

FROGS AND SWITCHES
Central Frog & Switch Co., Cincinnati, Ohio.

FURNACES, ROASTING
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

GAS (Cutting, Welding)
Prest-O-Lite Co., Inc., 30 E. 42d St., New York City.

GAS (Nitrogen, Oxygen)
Linde Air Products Co., 30 E. 42nd St., New York City.

GAUGES, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GEARS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

GEARS, BEVEL
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

What Nuttall BP Treatment Means to You

The untreated gear will be a 40 carbon steel. Its hardness is 140 Brinell, or a soft machine steel easily cut into with a file. Its strength will be 60,000 pounds per square inch. This is a good commercial grade of steel.

The BP Treatment raises the hardness of a 40 carbon steel from 140 to 500 Brinell, nearly 4 times as hard.

The surface strength is raised from 60,000 to 240,000 pounds per square inch; i. e., one square inch area will lift, instead of 30 tons, 120 tons. Yet this enormous increase in strength and hardness is accomplished, still retaining high toughness. Its impact resisting properties are tripled.

A close following of thousands of these gears and pinions in service has enabled us to guarantee 400% increase in life of this gear over the untreated gear in identical service. Our guarantee covers both breakage and wear.

BP GEARS ARE "TOUGH HARD"

R.D. NUTTALL COMPANY
PITTSBURGH PENNSYLVANIA

Philadelphia Office
Westinghouse Bldg.
30th and Walnut Streets

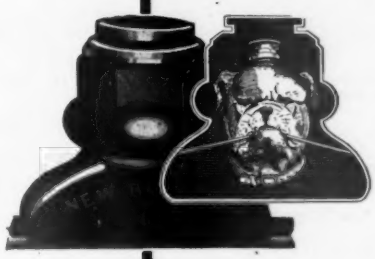
Chicago Office
2123 Conway Bldg.

Canadian Agent:
LYMAN TUBE & SUPPLY COMPANY
Toronto—Montreal

PATRICK CARBON
for Diamond Core Drilling

We know your satisfaction is our greatest asset. So we will not deviate from the principles that have built the Patrick prestige and reputation for skilled grading and honest values.

R. S. PATRICK
Duluth, Minnesota, U.S.A.
Cable Address, "Exploring" Duluth



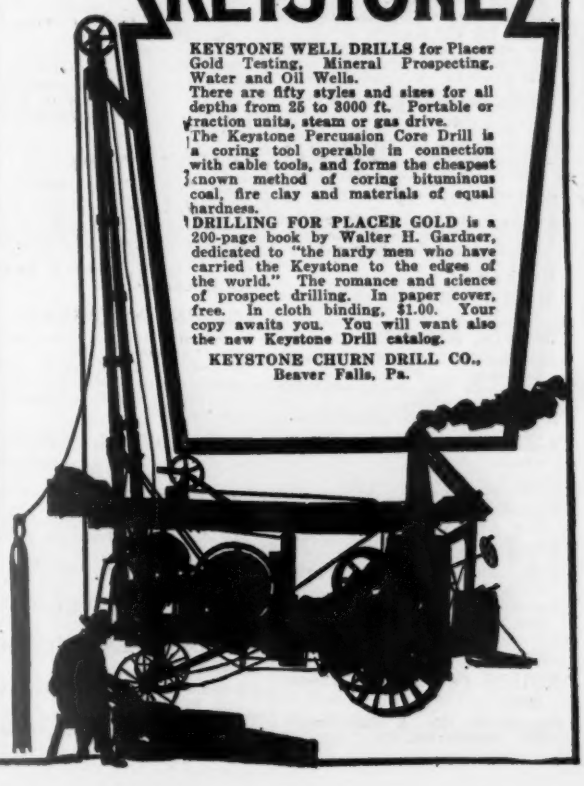
O-B Bulldog Trolley Clamps are as popular as pay day in the mines. These Bulldogs are easy to get acquainted with too. Just drop us a post card and we will send the complete introduction.

OHIO BRASS CO.
MANSFIELD, OHIO

In Canada
Dominion Insulator & Mfg. Co., Limited
Niagara Falls, Ont.

KEYSTONE

KEYSTONE WELL DRILLS for Placer Gold Testing, Mineral Prospecting, Water and Oil Wells.
There are fifty styles and sizes for all depths from 25 to 3000 ft. Portable or traction units, steam or gas drive.
The Keystone Percussion Core Drill is a coring tool operable in connection with cable tools, and forms the cheapest known method of coring bituminous coal, fire clay and materials of equal hardness.
DRILLING FOR PLACER GOLD is a 200-page book by Walter H. Gardner, dedicated to "the hardy men who have carried the Keystone to the edges of the world." The romance and science of prospect drilling. In paper cover, free. In cloth binding, $1.00. Your copy awaits you. You will want also the new Keystone Drill catalog.
KEYSTONE CHURN DRILL CO.,
Beaver Falls, Pa.



GEARS, REDUCTION
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

GEARS, HERRINGBONE
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

GEARS, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

GEARS, SPUR
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

GEARS, WORM
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.
Jeffrey Mfg. Co., 958 N. Fourth St., Columbus, Ohio.

GEARS, WORM WHEELS
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros., Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

GENERATORS AND GENERATING SETS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

GENERATORS, ACETYLENE
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GLOVES, ASBESTOS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

GOGGLES, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

HANGERS (Insulated Trolley)
Ohio Brass Co., Mansfield, Ohio.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

HEADLIGHTS, ARC AND INCANDESCENT
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Ohio Brass Co., Mansfield, Ohio.

HERRINGBONE GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

HOIST DRIVES
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

HOISTS
American Steel & Wire Co., Chicago and New York.

HOISTS, ELECTRIC
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Diamond Machine Co., Monongahela, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

HOISTS, PORTABLE
Ingersoll-Rand Co., 11 Broadway, New York City.

HOISTS, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

HOISTS (Room and Gathering)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

HOISTING ROPES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

HOSE, AIR AND STEAM
Ingersoll-Rand Co., 11 Broadway, New York City.

HOSE, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

INSULATORS, FEEDER WIRE
Ohio Brass Co., Mansfield, Ohio.

INSULATORS, SECTION
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Porcelain)
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Third Rail)
Ohio Brass Co., Mansfield, Ohio.

INSULATORS (Trolley)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

INSULATED WIRE AND CABLE
American Steel & Wire Co., Chicago, Ill.
Roebling Sons, John A., Trenton, N. J.

KILNS (Rotary)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

LAMPS, ARC AND INCANDESCENT
General Electric Co., Schenectady, N. Y.

LEAD BURNING APPARATUS, Oxy-Acetylene, Oxy-City Gas
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

LOADERS (Mine Car)
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOADERS, PORTABLE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOADING BOOMS
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

LOADING MACHINES
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

LOCOMOTIVES, ELECTRIC
General Electric Co., Schenectady, N. Y.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

LOCOMOTIVES, RACK RAIL
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

LOCOMOTIVES, STORAGE BATTERY
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MACHINERY, TRANSMISSION (Power)
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

MANIFOLDS, OXYGEN
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

MILLS, ROD & BALL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MILLS, STAMP
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MINE CAR BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

MINE DOORS, AUTOMATIC
American Mine Door Co., Canton, Ohio.

MINING & METALLURGICAL MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

MINING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

MINING MACHINES
Goodman Mfg. Co., Forty-eighth Place and Halsted St., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINING MACHINES (Electric)
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINING MACHINERY
Ingersoll-Rand Co., 11 Broadway, New York City.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

MINE SIGNALS
American Mine Door Co., Canton, Ohio.

MOTORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.

NITROGEN GAS
Linde Air Products, 30 East 42nd St., New York City.

ORE, BUYERS AND SELLERS OF
Irvington Smelting & Refining Works, Irvington, N. J.
Phelps-Dodge Corporation, New York City.

OXYGEN GAS
Linde Air Products, 30 East 42nd St., New York City.

OXY-ACETYLENE APPARATUS and SUPPLIES
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

PATENT ATTORNEY
John Boyle, Jr., Ouray Bldg., Washington, D. C.

PERMISSIBLES, Explosives
du Pont Powder Co., The E. I., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.

PICKING TABLES
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

PIPE (Wood)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PNEUMATIC TOOL
Ingersoll-Rand Co., 11 Broadway, New York City.

POWDER, BLASTING
E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.
Hercules Powder Co., 934 King St., Wilmington, Del.

POWER TRANSMISSION MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

PREHEATING APPARATUS
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

PROSPECTIVE DRILLS
H. R. Ameling Prospecting Co., Rolla, Mo.
Hoffman Bros., Punxsutawney, Pa.
Ingersoll-Rand Co., 11 Broadway, New York City.

PULLEYS
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

PULVERIZER SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

PULVERIZERS, COAL AND COKE
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

PUMPS, AIR LIFT
Ingersoll-Rand Co., 11 Broadway, New York City.

PUMPS, CENTRIFUGAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aurora Pump & Mfg. Co., Aurora, Ill.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, MINE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aurora Pump & Mfg. Co., Aurora, Ill.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS (Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aurora Pump & Mfg. Co., Aurora, Ill.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS (Gathering or Dip)
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

PUMPS, PNEUMATIC AIR LIFT
Ingersoll-Rand Co., 11 Broadway, New York City.

QUALITY

is remembered when price is forgotten.

Roebling "Blue Center" Steel Wire Rope

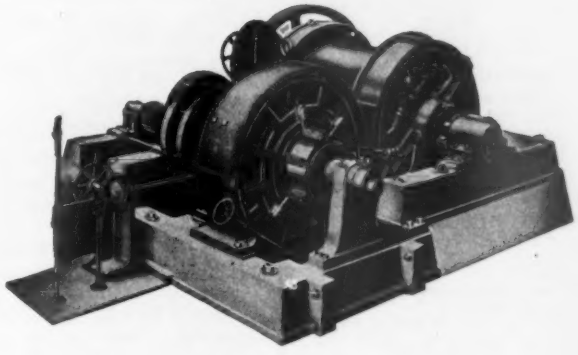
is a quality rope—designed to meet the most trying mine use.

John A. Roebling's Sons Co., Trenton, N. J.

THE KEYSTONE LUBRICATING CO.
Executive Office and Works: Philadelphia, Pa.

The Connellsville Manufacturing and Mine Supply Company

Connellsville, Pa.



If you need any cost reducing mine equipment, write us.

The Cage, Hoist and Fan Builder

SURE TO OPEN

CANTON AUTOMATIC MINE DOORS

Safeguard Life—Positive in operation — Open and close quickly — Simple in construction — Built for service —Prevent explosions — Conserve air.

NO INVESTMENT REQUIRED
ABSOLUTELY NONE
ASK US HOW WE DO IT
4000 IN USE

Can be Leased or Bought. Rental price per month saved in a few days. Purchase price saved in a few months.

Write for Catalog

American Mine Door Co.
916 Robin St.
Canton, Ohio

SURE TO CLOSE

ROCK DUSTING

in the most thorough and efficient manner is rapidly accomplished with

The Legrabon MINE DUSTING MACHINE

due to its positive feed, large capacity, high velocity of discharge and the peculiar construction of the nozzle.

Unvarying good performance in actual rock dusting practice for several months past has proven it a finished product and not an experiment.

Our new bulletin gives the details.

DIAMOND MACHINE COMPANY
Monongahela, Pa.

Selling Agents: Cooke-Wilson Electric Supply Company
Pittsburgh, Pa., Athens, Ohio, Charleston, W. Va.

PUMPS, POWER
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, SAND
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, STEAM
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works), 11 Broadway, New York City.

PUMPS, VACUUM
Ingersoll-Rand Co., 11 Broadway, New York City.

QUARRYING MACHINERY
Ingersoll-Rand Co., 11 Broadway, New York City.

RAIL BONDS
American Steel & Wire Co., Chicago and New York.
Ohio Brass Co., Mansfield, Ohio.

RAILWAY SUPPLIES
Ohio Brass Co., Mansfield, Ohio.

REGULATORS, Welding, Compressed Gas
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

REK-TANG ROLLED SLOT SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

RIDDLE WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

ROCK DRILLS
Ingersoll-Rand Co., 11 Broadway, New York City.

ROCK DUSTING MACHINES
Diamond Machine Co., Monongahela, Pa.

RODS, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

ROLLER BEARINGS
Hyatt Roller Bearing Co., Harrison, N. J.

ROLLS (Crushing)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

ROPE
American Steel & Wire Co., Chicago and New York.

ROPE, TRANSMISSION
American Steel & Wire Co., Chicago and New York.
Roebling Sons, John A., Trenton, N. J.

ROPE, WIRE
American Steel & Wire Co., Chicago and New York.
Roebling Sons, John A., Trenton, N. J.

SAFETY APPLIANCES, MINE
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.

SAFETY HORN CAR STOPS
G. M. Johnson Mfg. Co., Jeannette, Pa.

SCRAPER LOADERS
Goodman Mfg Co., Halsted St. and 48th Place, Chicago, Ill.

SCREEN WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

SCREENS, REVOLVING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SCREENS, SHAKER
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

SCREENS AND PERFORATED SHEETING
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

SHARPENERS, DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

SIEVE WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

SIGNS (Mine)
Stonehouse Signs, Inc., 842 Larimer St., Denver, Colo.

SILENT CHAINS
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

SINKERS, ROCK DRILL
Ingersoll-Rand Co., 11 Broadway New York City.

SKIPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

SMELTERS
Irvington Smelting & Refining Works, Irvington, N. J.

SPECIAL MACHINERY
Fawcus Machine Co., Pittsburgh, Pa.

SPEED REDUCERS
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

SPEED REDUCERS, TRIPLE
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

SPEED REDUCERS, DOUBLE
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

SPEED REDUCERS, SINGLE
Fawcus Machine Co., Pittsburgh, Pa.

SPLICE, CABLE
American Mine Door Co., Canton, Ohio.
Ohio Brass Co., Mansfield, Ohio.

SPLICE, INSULATOR
American Mine Door Co., Canton, Ohio.

SPLICE, TROLLEY WIRE
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

SPROCKETS
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

SPROCKETS, COMPENSATING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPROCKETS, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

SPROCKETS, SPRING
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

SPUR GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa.

SPUR REDUCERS
Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.

STAMP MILL SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

STEEL, ALLOY
Central Steel Co., Massillon, Ohio.

STEEL, HIGH FINISH SHEET
Central Steel Co., Massillon, Ohio.

STEEL, HOLLOW & SOLID DRILL
Ingersoll-Rand Co., 11 Broadway, New York City.

STEEL, REINFORCING
American Mine Door Co., Canton, Ohio.

STEEL, STRIP
Central Steel Co., Massillon, Ohio.

STOPERS, ROCK DRILL
Ingersoll-Rand Co., 11 Broadway New York City.

STORAGE BATTERY LOCOMOTIVES
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.

SWITCHBOARDS, POWER
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

SWITCHES (Disconnecting and Electric)
General Electric Co., Schenectady N. Y.

SWITCHES AND FROGS, TROLLEY
American Mine Door Co., Canton, Ohio.
Central Frog & Switch Co., Cincinnati, Ohio.
Ohio Brass Co., Mansfield, Ohio.

TIES, (Steel, Mine)
Central Frog & Switch Co., Cincinnati, Ohio.

TIMBER PRESERVING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TIPPLES
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

TIPPLE EQUIPMENT
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

TORCHES, Brazing, Carbon Burning, Cutting, Lead Burning, Welding, Welding and Cutting
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

TRACKS, PORTABLE, RAIL, ETC.
Central Frog & Switch Co., Cincinnati, Ohio.
West Virginia Rail Co., Huntington, W. Va.

TRACK, (Portable, Assembled and Unassembled, Riveted or Bolted),
Central Frog & Switch Co., Cincinnati, Ohio.

TRACK SUPPLIES
Central Frog & Switch Co., Cincinnati, Ohio.

TRANSFORMERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TRANSMISSION, SILENT CHAIN
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.

TROLLEY FROGS
Ohio Brass Co., Mansfield, Ohio.

TROLLEY (Hangers and Clamps)
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio.

TROLLEY MATERIAL, OVERHEAD
Ohio Brass Co., Mansfield, Ohio.

TROLLEY WHEELS AND HARPS
Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Ohio Brass Co., Mansfield, Ohio.

TRUCKS, WELDER'S
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

TURBINES, HYDRAULIC
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

TURBINES, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

VALVES
Ohio Brass Co., Mansfield, Ohio.

VALVES, Back Pressure, Pressure Reducing
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WAGON LOADERS
The Jeffrey Mfg. Company, 958-99 North 4th St., Columbus, Ohio.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Weller Mfg. Co., 1820-56 N. Kostner Ave., Chicago, Ill.

WASHERIES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Link-Belt Co., 300 W. Pershing Rd., Chicago, Ill.

WASHER SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

WELDING and CUTTING APPARATUS, Etc. (Oxy-Acetylene)
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WELDING APPARATUS, ELECTRIC ARC
Ohio Brass Co., Mansfield, Ohio.

WELDING GAS
Prest-O-Lite Co., Inc., 30 E. 42nd St., New York City.

WELDING SUPPLIES
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WIRE AND CABLE
American Steel & Wire Co., Chicago and New York.
Roebling Sons, The John A., Trenton, N. J.

WIRE CLOTH
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

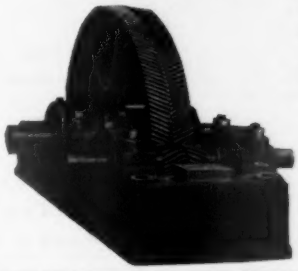
WIRE ROPE FITTINGS
American Steel & Wire Co., Chicago and New York.

WIRE SCREENS
Ludlow-Saylor Wire Co., 608 S. Newstead Ave., St. Louis, Mo.

WIRE, WELDING
Oxweld Acetylene Co., 30 E. 42nd St., New York City.

WORM GEAR DRIVES
Fawcus Machine Co., Pittsburgh, Pa

FAWCUS

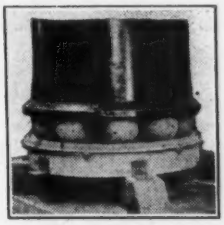


Use Fawcus Herringbone Gear Drives for driving your hoists, fans, conveyors, picking tables, pumps and compressors. They save 25% to 50% in maintenance and operating costs.

FAWCUS MACHINE CO.
PITTSBURGH, PA.

No shafts, no gear, no friction. Will crush with 1 h. p. as much as 10 h. p. will crush with stamps.

5-ton mill, ½ h. p., $225; 10-ton mill, $475; 35-ton mill, $950. Up to 500 tons per day.



ELLIS BALL-CHILI MILL

ELLIS MILL COMPANY
OFFICE: 147 PROSPECT AVENUE
Show Room: 153 Stillman St. (near 3d and Bryant)
SAN FRANCISCO, CALIF.

ROTARY CAR DUMPERS FOR MINE CARS
(GRAVITY, ELECTRIC OR PNEUMATIC DRIVE)
"SOLIDCAR" SELF-DUMPING CAGES
ROTARY DUMPERS FOR RAILROAD CARS
NON-SPILLAGE GATES FOR SKIP LOADING
CAR-DUMPER & EQUIPMENT CO.
CAR CONTROL AND CAGING EQUIPMENT
AUTOMATIC TRIP CONTROL DEVICES
MECHANICAL SPRAGGERS—STAR WHEEL OR CHAIN
MAIN OFFICE AND WORKS, GRAND CROSSING, CHICAGO
PITTSBURGH OFFICE, WESTINGHOUSE BUILDING

Irvington Smelting and Refining Works

Buyers, Smelters and Refiners of
Gold, Silver, Lead, Copper and Platinum
Ores, Sweeps and Bullion
Manufacturers of Copper Sulphate

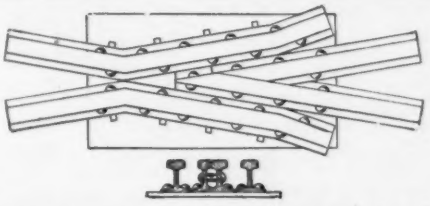
IRVINGTON :-: NEW JERSEY

NEW YORK OFFICE—Charles Engelhard
Hudson Terminal Building 30 Church Street

CORE DRILLING
H. R. AMELING PROSPECTING COMPANY, INC.
Diamond Drill Contractors
20 Years' Continuous Service
Not a Dissatisfied Customer
ROLLA, MISSOURI
Home: State Geologic Survey, Missouri School of Mines

Phelps Dodge Corporation
99 JOHN STREET - - NEW YORK
MEMBER COPPER & BRASS RESEARCH ASSOCIATION
Copper
"C ★ Q" Electrolytic
"P. D. Co." Casting

Stonehouse SIGNS, INC.
Stock and Special Signs, Codes, etc., for Mines



Rugged Equipment—Prompt Shipment
Rugged track equipment designed to meet every mine requirement. Our central location guarantees prompt shipment. Send for catalog.
THE CENTRAL FROG & SWITCH COMPANY
CINCINNATI, OHIO

ORVIS C. HOFFMAN, Pres. LEON H. HOFFMAN, Treas.
HOFFMAN BROS. DRILLING CO.
CONTRACTORS
DIAMOND CORE DRILLING
PUNXSUTAWNEY, PA.
PROSPECTING FOR ANY MINERAL. MORE THAN 20 YEARS EXPERIENCE. SATISFACTION GUARANTEED

American Mining Congress

OFFICERS AND COMMITTEES, 1926

OFFICERS

President

E. L. Doheny, *First Vice-President*
Wm. H. Lindsey, *Second Vice-President*
Robert E. Tally, *Third Vice-President*
J. F. Calbreath, *Secretary*

DIVISION STAFF

E. C. Porter, *Convention Manager*
George H. Bailey, *Counsel*
M. W. Kriegh, *Tax Division*
Dr. Henry Mace Payne, *Consulting Engineer*
E. H. Pullman, *Publicity Department*
E. R. Coombes, *Asst. to Secretary*

DIRECTORS

Bulkeley Wells, San Francisco, Calif.
Sidney J. Jennings, New York, N. Y.
Daniel B. Wentz, Philadelphia, Pa.
George B. Harrington, Chicago, Ill.
Wm. H. Lindsey, Nashville, Tenn.
J. G. Bradley, Dundon, W. Va.
W. J. Loring, Los Angeles, Calif.
H. W. Seaman, Chicago, Ill.
E. L. Doheny, New York, N. Y.
Hugh Shirkie, Terre Haute, Ind.
Stanly Easton, Kellogg, Idaho.
L. S. Cates, Salt Lake City, Utah.
Robert E. Tally, Clarkdale, Ariz.

EXECUTIVE COMMITTEE

H. W. Seaman — Daniel B. Wentz
George B. Harrington

WESTERN DIVISION

BOARD OF GOVERNORS

Jesse F. McDonald, Denver Colo., *Chairman of the Division.*
M. B. Tomblin, 437 State Office Bldg., Denver, Colo., *Secretary of the Division.*
Arizona—Robert E. Tally, United Verde Copper Co., Jerome, Ariz.; W. B. Gohring, 419 Heard Building, Phoenix, Ariz.
California—Robert I. Kerr, 509 United Bank & Trust Co. Bldg., 625 Market St., San Francisco, P. C. Knapp, Natomas Co. of Calif., San Francisco.
Colorado—Jesse F. McDonald, Denver, Colo.; M. B. Tomblin, 437 State Office Building, Denver, Colo.
Idaho—A. P. Ramstedt, Wallace, Idaho; Ravenel Macbeth, Idaho Mining Association, Wallace, Idaho.
Nevada—Henry M. Rives, Nevada Mine Operators' Assn., Reno, Nev.
New Mexico—John M. Sully, Chino Copper Co., Hurley, N. M.; Jos. Woodbury, New Mexico Chapter, The American Mining Congress, Silver City, N. Mex.
Oregon—Robert M. Betts, Cornucopia Mining Co., Cornucopia, Oreg.
South Dakota— B. C. Yates, Homestake Mining Co., Lead, S. Dak.
Utah—V. S. Rood, Utah Apex Mining Co., Bingham, Utah; A. G. Mackenzie, 212 Kearns Building, Salt Lake City, Utah.
Washington—Raymond Guyer, Symons Building, Spokane, Wash.

SOUTHERN DIVISION

BOARD OF GOVERNORS

W. H. Lindsey, Napier Iron Works, Nashville, Tenn., *Chairman of the Division.*
J. B. McClary, Yolande Coal & Coke Co., Birmingham, Ala.
Percy D. Berry, Providence Coal Mining Co., Providence, Ky.
Lee Long, Clinchfield Coal Corporation, Dante, Va.
E. L. Hertzog, Cherokee Mining Co., Spartansburg, S. C.
W. S. Peebles, The, Paga Mining Co., Cartersville, Ga.
S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.
H. B. Flowers, New Orleans Public Service, Inc., New Orleans, La.
C. J. Griffith, Arkansas Central Power Co., Little Rock, Ark.
Dr. Joseph Hyde Pratt, Consulting Engineer, Biltmore Forest, Biltmore, N. C.
W. H. Smith, Secy.-Mgr., Chamber of Commerce, Laurel, Miss.
C. G. Memminger (Florida), Pres., Coronet Phosphate Co., Asheville, N. C.

MANUFACTURERS DIVISION

OFFICERS

Honorary Chairman

N. S. Greensfelder, Hercules Powder Co., Wilmington, Del.

Chairman

J. C. Wilson, Ohio Brass Co., Mansfield, Ohio.

Vice-Chairmen

H. K. Porter, Hyatt Roller Bearing Co., Harrison, N. J.
C. L. Herbster, Hockensmith Wheel & Mine Car Co., Penn, Pa.
H. A. Buzby, Keystone Lubricating Co., Philadelphia, Pa.

Members

American Car & Foundry Co., 165 Broadway, New York City. H. C. Wick.
Atlas Powder Co., Wilmington Del. G. S. Scott.
Automatic Reclosing Circuit Breaker Co., Columbus, Ohio. C. M. Hickle.
Carnegie Steel Co., Pittsburgh, Pa. R. L. Twitchell.
Central Frog & Switch Co., Cincinnati, Ohio. E. R. Heitzmann.
Cutler-Hammer Mfg. Co., Milwaukee, Wisc. G. S. Crane.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. E. F. Carley.
Edison Storage Battery Co., Orange, N. J. G. E. Stringfellow.
Electric Railway Equipment Co., Cincinnati, Ohio. A. L. Johnston.
Enterprise Wheel & Mine Car Corp., Bristol, Va.-Tenn. C. P. Daniels.
General Electric Co., Schenectady, N. Y. L. W. Shugg.
Hendrick Mfg. Co., Carbondale, Pa. H. S. Lee.
Hercules Powder Co., Wilmington, Del. N. S. Greensfelder.
Hockensmith Wheel & Mine Car Co., Penn, Pa. C. L. Herbster.
Robt. Holmes & Bros., Inc., Danville, Ill. Grant Holmes, Pres.
Hyatt Roller Bearing Co., Newark, N. J. H. K. Porter.
Keystone Consolidated Publishing Co. Ralph C. Becker, 10th Ave. at 36th St., New York City.
Keystone Lubricating Co., Philadelphia, Pa. H. A. Buzby.
Link-Belt Co., Chicago, Ill. W. W. Sayers.
Ludlow-Saylor Wire Co., St. Louis, Mo. Duncan Meier.
Mancha Storage Battery Locomotive Co., St. Louis, Mo. Raymond Mancha.
Myers-Whaley Co., Knoxville, Tenn. Wm. A. Whaley.
Morse Chain Co., Ithaca, N. Y. C. L. Saunders.
National Carbon Co., Inc., 30 E. 42d St., New York City. E. A. Williford.
Ohio Brass Co., Mansfield, Ohio. J. C. Wilson.
Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill. Col. W. R. Roberts, Pres.
John A. Roebling's Sons Co., Trenton, N. J. F. J. Maple.
Southern Wheel Co., St. Louis, Mo. F. C. Turner, Vice-Pres., 1308 Keystone Bldg., Pittsburgh, Pa.
Streeter-Amet Weighing & Recording Co., Chicago, Ill. H. F. Reck.
Timken Roller Bearing Co., Canton, Ohio. E. R. Phillips.
W. S. Tyler Co., Cleveland, Ohio. M. P. Reynolds.
Watt Car & Wheel Co., Barnesville, Ohio. H. H. Watt.
Weir Kilby Corpn., Cincinnati, Ohio. J. K. Lansdowne.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. P. H. Grunnagle.

TAX DIVISION

GENERAL TAX COMMITTEE

Paul Armitage, *Chairman*
233 Broadway, New York, N. Y.
Geo. E. Holmes, *Vice-Chairman*
15 William St., New York, N. Y.

R. C. Allen, Hanna Building, Cleveland, Ohio.
A. Scott Thompson, Miami, Okla.
Wm. B. Gower, 20 Exchange Place, New York, N. Y.
R. V. Norris, 520 Second National Bank Bldg., Wilkes-Barre, Pa.
J. C. Dick, 511 Newhouse Bldg., Salt Lake City, Utah.
A. P. Ramstedt, Wallace, Idaho.
E. L. Doheny, 120 Broadway, New York City.
T. O. McGrath, Bisbee, Ariz.
Robt. N. Miller, Southern Bldg., Washington, D. C.
H. B. Fernald, 50 Broad St., New York City.
T. T. Brewster, Federal Res. Bank Bldg., St. Louis Mo.
Wm. N. Davis, Bartlesville, Okla.

STANDARDIZATION DIVISION

Metal and Coal Mining Branches

COAL MINING BRANCH

General Committee

Colonel Warren R. Roberts (*Chairman*), Pres., Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.
R. L. Adams, Chf. Engr., Old Ben Coal Corpn., Christopher, Ill.
D. J. Carroll, Chicago, Wilmington & Franklin Coal Co., 332 South Michigan Ave., Chicago, Ill.
A. B. Kiser, Supt. of Elec. Equipment, Pittsburgh Coal Co., Pittsburgh, Pa.
J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., 2307 First Natl. Bank Bldg., Pittsburgh, Pa.
James Needham, Genl. Supt. of Mines, St. Paul Coal Co., 1368 Fullerton Ave., Chicago, Ill.
Fred Norman, Chf. Engr., Allegheny River Mining Co., Kittanning, Pa.
F. L. Stone, Industrial Engr. Dept., General Electric Co., Schenectady, N. Y.
C. H. Trik, Sales and Mine Ventilation Engr., Jeffrey Mfg. Co., Columbus, Ohio.

Underground Transportation
Fred Norman, *Chairman*

MAIN COMMITTEE

Fred Norman (*Chairman*), Chf. Engr., Allegheny Rivers Mining Co., Kittanning, Pa.
Frank S. Barks, Pres., Lincoln Steel and Forge Co., St. Louis, Mo.
Graham Bright, Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
Jos. Bryan, Salesman, General Electric Co., 535 Smithfield St., Pittsburgh, Pa.
John T. Cherry, Genl. Supt., B. F. Berry Coal Co., Standard, Ill.
Frederick C. Coseo, Chf. Draftsman, Jeffrey Mfg. Co., Columbus, Ohio.
A. H. Ehle, Mgr., Domestic Sales, Baldwin Locomotive Works, 500 N. Broad St., Philadelphia, Pa.
W. J. Fene, Asst. Chf. Engr., Mine Safety Service, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
Robert J. Forester, Supt., Paradise Coal Co., Du Quoin, Ill.
J. B. Forrester, Chf. Engr., United States Fuel Co., Hiawatha, Utah.
D. F. Lepley, Pres. & Genl. Mgr., Connellsville Mfg. and Supply Co., Connellsville, Pa.
J. D. Martin, Genl. Supt. of Coal Mines, Virginia Iron, Coal & Coke Co., Payne Bldg., Roanoke, Va.
Charles M. Means, Cons. Engr., Charles M. Means Company, 447 Oliver Bldg., Pittsburgh, Pa.
James Milliken, Pres., Pittsburgh Testing Laboratory, P. O. Box 1115, Pittsburgh, Pa.
T. A. Parker, 407 Olive St., St. Louis, Mo.
Chas. H. Partington, Chief Engr., Cincinnati Frog & Switch Co., Cincinnati, Ohio.
H. K. Porter, Car & Truck Dept., Hyatt Roller Bearing Co., Newark, N. J.
G. H. Shapter, Commercial Engr., Industrial Dept., General Electric Co., Erie, Pa.
E. A. Watters, Genl. Supt., Hick Coal Companies, Box 405, Leechburg, Pa.
C. E. Watts, Mech. Engr., Berwind White Coal Mining Co., Windber, Pa.

SUB-COMMITTEE NO. 1—COAL MINE CAR DESIGN AND CONSTRUCTION

Arthur Neale (Chairman), Ass't. Genl. Mgr. of Mines, Pittsburgh Coal Co., 1018 Oliver Bldg., Pittsburgh, Pa.
H. M. Estabrook, Standard Steel Car Co., Frick Bldg., Pittsburgh, Pa.
C. L. Herbster, Vice-Pres., Hockensmith Wheel & Mine Car Co., Penn, Pa.
R. L. Kingsland, Genl. Supt., Power & Mechanical Dept., Consolidation Coal Co., Fairmont, W. Va.
James Milliken, Pres., Pittsburgh Testing Laboratory, P. O. Box 1115, Pittsburgh, Pa.
W. C. Sanders, Rwy. Equipment Engr., Timken Roller Bearing Co., Canton, Ohio.
C. E. Watts, Mech. Engr., Berwind White Coal Mining Co., Windber, Pa.
Victor Willoughby, Gen. Mech. Engr., Amer. Car & Foundry Co., 165 Broadway, New York City.
C. K. Witmer, Master Mechanic, Westmoreland Coal Co., Irwin, Pa.

SECTIONAL COMMITTEE ON TYPES OF HAND BRAKES

R. H. Kudlich (Chairman), U. S. Bureau of Mines, Washington, D. C.
Thos. G. Fear, Genl. Supt., Inland Collieries Co., Indianola, Pa.
Wm. J. Hill, Senior Mine Inspector, Travelers Insurance Co., 1103 Commonwealth Bldg., Pittsburgh, Pa.
W. H. Robinson, Chf. Inspector, The Associated Companies, 207 Fulton Bldg., Pittsburgh, Pa.

SECTIONAL COMMITTEE ON MINE CAR WHEELS

C. K. Witmer (Chairman), Master Mechanic, Westmoreland Coal Co., Irwin, Pa.
W. E. Farrell, Pres., Easton Car and Construction Co., Easton, Pa.
John M. Lewis, Chf. Engr., Houston Coal and Coke Co., 1532 Union Trust Bldg., Cincinnati, O.
Arthur Neale, Asst. Genl. Mgr. of Mines, Pittsburgh Coal Co., 1018 Oliver Bldg., Pittsburgh, Pa.
Cecil W. Smith, Chf. Engr., Illinois Coal Corpn., 1380 Old Colony Bldg., Chicago, Ill.
W. G. Srodes, Supt., Coal and Coke Dept., Shenango Furnace Co., Ligonier, Pa.

SUB-COMMITTEE NO. 2—MINE TRACKS AND SIGNALS

Chas. H. Partington (*Chairman*), Chief Engineer, The Cincinnati Frog & Switch Co., Cincinnati, Ohio.

THE LEHIGH COAL AND NAVIGATION COMPANY

Miners and Shippers

OLD COMPANY'S LEHIGH

For Over a Century

1820 ANTHRACITE 1926

"The Best Since 1820"

437 CHESTNUT STREET - PHILADELPHIA, PENNSYLVANIA

JOHN BOYLE, JR.

Attorney-at-Law

Patents

B. S. IN MINING ENGINEERING AND METALLURGY. SIXTEEN YEARS IN THE EXAMINING CORPS OF THE UNITED STATES PATENT OFFICE.

OURAY BUILDING, WASHINGTON, D. C.

FOR SALE

1 HAMILTON CORLISS ENGINE

Cylinder 20" x 48". Band wheel 16' x 33". This engine has been kept in the highest state of efficiency. Removed because we needed more power.

1 ERIE CITY SLIDE VALVE ENGINE

Cylinder 18" x 22". Balance wheel 84" x 24½". This engine has been kept in most excellent order. Was removed because we needed more power.

Both above ENGINES can be seen here any time. They will give excellent service.

Also a lot of used PULLEYS and HANGARS in good used condition. Ask for particulars.

MT. VERNON CAR MFG. CO.
Mt. Vernon, Ill.

AT YOUR SERVICE

IF YOU HAVE business in Washington with any of the government departments, the American Mining Congress will be glad to serve its active members without charge, in any way consistent with its purposes, either in obtaining information, securing public documents, in advising as to the progress of legislation, or in the consideration of complaints.

The American Mining Congress is an organization of service. Write us how we may serve you.

THE AMERICAN MINING CONGRESS
Munsey Building, Washington, D. C.

RADIUM ORE

High and Low Grade Carnotite containing Uranium and Vanadium.

O. BARLOW WILLMARTH

Montrose, Colo., U. S. A.

G. M. JOHNSON MFG. CO. Jeannette, Pa.

MANUFACTURERS OF

Mine Cages & Automatic Caging Devices.
Safety Horn Car Stops.
Chain Rail Car Hauls.
Automatic Gravity Feeders.
Automatic Switch Throwers.

OFFICERS AND COMMITTEES, 1926—(Continued)

C. A. Alden, Chief Engineer, Frog & Switch Dept., Bethlehem Steel Co., Steelton, Pa.
Geo. Ashton, Pres., The Central Frog & Switch Co., Cincinnati, Ohio.
Geo. M. Crawford, Crawford Machinery Co., Bessemer Bldg., Pittsburgh, Pa.
A. A. Culp, Consulting Engineer, Brown-Marx Bldg., Birmingham, Ala.
T. H. Edelblute, Representative of the Cincinnati Frog & Switch Co., Wabash Bldg., Pittsburgh, Pa.
Wm. F. Henke, Asst. Engr., the Cincinnati Frog & Switch Co., Cincinnati, Ohio.
F. C. Hohn, Consulting Engineer, Pennsylvania Appraisement Co., Scranton, Pa.
Wm. G. Hulbert, Genl. Supt., Wm. Wharton, Jr., Company, Easton, Pa.
R. L. Ireland, Jr., M. A. Hanna Co., Cleveland, Ohio.
H. L. Koch, Mgr., Industrial Dept., Sweet's Steel Co., Williamsport, Pa.
Fred Norman, Chief Engineer, Allegheny River Mining Co., Kittanning, Pa.
W. Perdue, Chief Engineer, Western Plants, Ramapo-Ajax Corporation, Chicago, Ill.
S. F. Perry, Representative of the Cincinnati Frog & Switch Co., Pittsburgh, Pa.
J. B. Strong, President, Ramapo-Ajax Corporation, 30 Church St., New York City.
J. R. Ulrich, Bethlehem Steel Co., Bethlehem, Pa.
H. N. West, Chief Engineer, Weir-Kilby Corporation, Norwood, Ohio.

SUB-COMMITTEE NO. 3—MINE LOCOMOTIVES

Graham Bright (*Chairman*), Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
Jos. Bryan, Salesman, General Electric Co., 535 Smithfield St., Pittsburgh, Pa.
Frederick C. Coseo, Chf. Draftsman, Jeffrey Mfg. Co., Columbus, Ohio.
Thos. F. Downing, Jr., The Edw. V. d'Invilliers Engr. Co., Central Bldg., Philadelphia, Pa.
A. H. Ehle, Mgr., Domestic Sales, Baldwin Locomotive Works, 500 N. Broad St., Philadelphia, Pa.
S. W. Farnham, Mng., Engr., Goodman Mfg. Co., 4834 S. Halstead St., Chicago, Ill.
W. J. Fene, Asst. Chf. Engr., Mine Safety Service, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
G. H. Shapter, Commercial Engr., Industrial Dept., General Electric Co., Erie, Pa.

Mining and Loading Equipment

D. J. Carroll, *Chairman*

SUB-COMMITTEE NO. 1—LOADERS

SECTION "A"—LOADING MACHINES AND METHODS OF LOADING

Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
G. W. Hay, Gen'l Mgr., Consolidation Coal Co., Jenkins, Ky.
T. E. Jenkins, Vice-Pres., West Kentucky Coal Co., Sturgis, Ky.
J. F. Joy, Franklin, Pa.
N. D. Levin, Jeffrey Mfg. Co., Columbus, O.
Rex Martin, Link-Belt Co., 910 S. Mich. Ave., Chicago, Ill.
N. H. McClevey, Vice-Pres. and Gen'l Mgr., Pike County Coal Corpn., Petersburg, Ind.
W. D. Turnbull, Genl. Engr. Dept., Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
William Whaley, Gen'l Mgr., Myers-Whaley Co., Knoxville, Tenn.

SECTION "B"—IN THICK AND THIN COAL, WITH VARYING ROOF CONDITIONS

E. K. Bowers, Ass't Treas., Morgan-Gardner Elec. Co., 2640 Shields Ave., Chicago, Ill.
Frank E. Cash, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
S. W. Farnham, Mng. Engr., Goodman Mfg. Co., Halsted St. and 48th Pl., Chicago, Ill.
Walter Stevens, Supt., Raleigh-Wyoming Coal Co., Glen Rogers, W. Va.
F. W. Whiteside, Chf. Engr., Victor-American Fuel Co., Denver, Colo.

SUB-COMMITTEE NO. 2—CONVEYORS

Newell G. Alford, Mng. Engr., Union Trust Bldg., Pittsburgh, Pa.
E. H. Coxe, 30 Oakland Ave., Uniontown, Pa.
T. W. Dawson, Cons. Engr., H. C. Frick Coke Co., Scottdale, Pa.
Chas. Gottschalk, Cons. Engr., 920 Citizens Bank Bldg., Evansville, Indiana.
G. A. Knox, Supt. Gunn-Quealy Coal Co., Gunn, Wyoming.
E. F. Miller, Gen'l Supt., Bertha-Consumers Coal Co., Rachel, W. Va.
G. B. Southward, Coal Service Corporation, 2 Rector St., New York City.
D. A. Stout, Mgr., Fuel Dept., Colorado Fuel and Iron Co., Pueblo, Colorado.
F. G. Wilcox, Pres., West End Coal Co., Scranton, Pa.
J. D. Zook, Vice-Pres., Illinois Coal Corpn., 37 Van Buren St., Chicago, Ill.

SUB-COMMITTEE NO. 3—CUTTING MACHINES

Carl Scholz (Chairman), Vice-Pres., Raleigh-Wyoming Coal Co., Charleston, W. Va.
Walter Calverley, Pres., Fayette Coal Corpn., Farmers Bank Bldg., Pittsburgh, Pa.
A. P. Cameron, Gen'l Mgr., Westmoreland Coal Co., Irwin, Pa.
J. M. Clark, Vice-Pres., Clark & Krebs, Inc., Charleston, W. Va.
H. P. Dyer, Gen'l Mgr., Vandalia Coal Co., Sullivan, Ind.
G. T. Haldeman, U. S. Bureau of Mines, Washington, D. C.
Wm. E. Hamilton, Mgr., Hamilton Engineering Co., 310 Schultz Bldg., Columbus, O.
E. S. McKinlay, Pres., McKinlay Mining and Loading Machine Co., Point Pleasant, W. Va.
M. Mitchell, Sullivan Machinery Co., St. Louis, Mo.

Mine Drainage

I. A. Malady, *Chairman*

SUB-COMMITTEE NO. 1—PUMPS FOR DEVELOPMENT WORK

L. W. Householder (*Chairman*), Chf. Engr., Rochester & Pittsburgh Coal & Iron Co., Indiana, Pa.
E. F. Austin, Dravo-Doyle Co., Pittsburgh, Pa.
Herbert Axford, Sales Engr., Ingersoll-Rand Co., 610 Spruce St., Scranton, Pa.
Harold P. Dyer, Genl. Mgr., Vandalia Coal Co., Sullivan, Ind.
J. H. Edwards, Associate Editor, Coal Age, 2962 Winters Rd., Huntington, W. Va.
F. J. Emeny, Vice Pres., The Deming Co., Salem, Ohio.
J. E. Holveck, Dist. Mgr., Aldrich Pump Co., 1209 Empire Bldg., Pittsburgh, Pa.
G. E. Huttle, Mech. Engr., H. C. Frick Coke Co., Scottdale, Pa.
Chas. H. Matthews, Genl. Engr. in Chg. Mining Section, Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
H. J. Nelms, Genl. Supt., New Field By-Products Coal Co., North Bessemer, Pa.
F. W. Smith, Hydroelectric Pump & Supply Co., Curry Bldg., Pittsburgh, Pa.

SUB-COMMITTEE NO. 2—PERMANENT PUMPING STATIONS

Parker Cott (*Chairman*), Salesman, Coal Mine Equipment Co., 2218 Farmers Bank Bldg., Pittsburgh, Pa.
Herbert Axford, Sales Engr., Ingersoll-Rand Co., 610 Spruce St., Scranton, Pa.
Henry E. Cole, Vice Pres., Harris Pump & Supply Co., 320 Second Ave., Pittsburgh, Pa.
J. P. Heidenreich, Asst. Genl. Mgr., Scranton Pump Co., Scranton, Pa.
W. L. Robison, Vice Pres., Youghiogheny & Ohio Coal Co., 1230 Hanna Bldg., Cleveland, O.
R. F. Roth, Emmons Coal Mining Co., Altoona, Pa.
Cecil W. Smith, Chf. Engr., Illinois Coal Corpn., 1380 Old Colony Bldg., Chicago, Ill.
M. Spillman, Works Engr., Worthington Pump & Machinery Corpn., Harrison, N. J.
L. D. Tracy, Supt., U. S. Bureau of Mines, 312 Ceramics Bldg., Urbana, Ill.

SUB-COMMITTEE NO. 3—NATURAL DRAINAGE

John Brunschwyler (*Chairman*), Div. Supt., Boomer Coal & Coke Co., Boomer, W. Va.
M. C. Benedict, Cons. Engr., Brown Equipment Co., 940 Ash St., Johnstown, Pa.
Oscar Cartlidge, Cons. Engr., 1593 Lee St., Charleston, W. Va.
L. P. Crecelius, Engr., Cleveland & Western Coal Co., 1517 Union Trust Bldg., Cleveland, Ohio.
E. D. Knight, 2207 Washington St., Charleston, W. Va.
R. Y. Wert, Supt., Durham Coal & Iron Co., Soddy, Tenn.

SUB-COMMITTEE NO. 4—UNWATERING ABANDONED WORKINGS

Prof. John W. Hallock (*Chairman*), Head of Department of Industrial Engineering, University of Pittsburgh, Pittsburgh, Pa.
G. E. Huttle, Mech. Engr., H. C. Frick Coke Co., Scottdale, Pa.
J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., Pittsburgh, Pa.
O. M. Pruitt, Pres., Indiana Air Pump Co., Indiana Pythian Bldg., Indianapolis, Ind.
Chas. A. Straw, Cons. Mech. Engr., Hudson Coal Co., 434 Wyoming Ave., Scranton, Pa.
G. V. Woody, Mgr., Allis-Chalmers Mfg. Co., Wilkes-Barre, Pa.

SUB-COMMITTEE NO. 5—MINE WATER AND ITS ACTION UPON MINE DRAINAGE EQUIPMENT

Geo. A. Drysdale (*Chairman*), Metallurgical Editor, Foundry, Penton Publishing Co., Cleveland, Ohio.
M. L. Bettcher, Production Engr., The Duriron Co., Inc., Dayton, Ohio.
J. R. Campbell, Hudson Coal Co., Scranton, Pa.
Geo. Watkin Evans, Cons. Coal Mng. Engr., L. C. Smith Bldg., Seattle, Wash.
Carl J. Fletcher, Vice Pres., Knox Coal Mng. Co., Merchants Bank Bldg., Indianapolis, Ind.
C. L. Harrod, Elec. Engr., Indiana Coal Oprs. Power Assn., 1509 Merchants Bank Bldg., Indianapolis, Ind.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
Frank G. Morris, Genl. Supt. of Mines, Republic Iron & Steel Co., Sayreton, Ala.
L. D. Rover, Power & Construction Dept., Ford Motor Co., Detroit, Mich.
W. H. Waddington, Sales Engr., Driver-Harris Co., Harrison, N. J.

Mine Ventilation

C. H. Trik, *Chairman*

SUB-COMMITTEE NO. 1—AIR SHAFTS AND AIR WAYS

J. C. Gaskill (*Chairman*), Asst. Cons. Engr., Consolidation Coal Co., Fairmont, W. Va.
C. H. Beidenmiller, Mgr., Glogora Coal Co., 705 First Natl. Bank Bldg., Huntington, W. Va.
J. H. Doughty, Mech. Engr., Lehigh & Wilkes-Barre Coal Co., 16 So. River St., Wilkes-Barre, Pa.
Robert Wallace, Supt., Pocahontas Fuel Co., Inc., Pocahontas, Va.
Jos. J. Walsh, Secretary of Mines, Pennsylvania Dept. of Mines, Harrisburg, Pa.

SUB-COMMITTEE NO. 2—MINE FAN INSTALLATION

G. E. Lyman (*Chairman*), Genl. Supt., Madison Coal Corpn., Glen Carbon, Ill.
H. G. Conrad, Genl. Mgr., American Coal Mining Co., Bicknell, Ind.
R. B. Fleming, Evansburg Coal Co., Colver, Pa.
E. B. Wagner, Lehigh Valley Coal Co., Wilkes-Barre, Pa.

SUB-COMMITTEE NO. 3—BOOSTER FANS

R. Dawson Hall (*Chairman*), Engineering Editor, Coal Age, 10th Ave. at 36th St., New York City.
Howard N. Eavenson, Pres., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
R. H. Moore, Genl. Mgr., C. A. Hughes & Co., Portage, Pa.
E. N. Zern, Editor, Mining Catalog, Keystone Cons. Publishing Co., 800 Penn Ave., Pittsburgh, Pa.

SUB-COMMITTEE NO. 4—MINE ATMOSPHERE

Thomas Chester (*Chairman*), Cons. Engr., 718 B. Copeland St., Pittsburgh, Pa.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
R. M. Perry, Genl. Supt., Moffat Coal Co., 504 Gas & Elec. Bldg., Denver, Colo.

Outside Coal Handling Equipment

James Needham, *Chairman*

Hubb Bell, Sales Chemist, C. P. Chemical & Drug Co., Inc., 114 Liberty St., New York City.
J. W. Bischoff, Vice Pres. & Genl. Mgr., West Virginia Coal & Coke Co., Elkins, W. Va.
W. G. Duncan, Jr., Supt., W. G. Duncan Coal Co., Greenville, Ky.
H. H. Elkins, Supt. of Mines, Valley Camp Coal Co., St. Clairsville, Ohio.
W. C. Henning, Secretary and Treasurer, A. Leschen & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo.
M. A. Kendall, Chf. Engr., Stephens-Adamson Mfg. Co., Aurora, Ill.
Rudolf Kudlich, Asst. to Chf. Mech. Engr., U. S. Bureau of Mines, Washington, D. C.
John J. Moore, Dey & Maddock, 82d and Dennison Sts., Cleveland, Ohio.
F. G. Morris, Genl. Supt. of Coal Mines, Republic Iron & Steel Co., Sayreton, Ala.
G. H. Morse, Genl. Supt., Republic Iron & Steel Co., Oliver Bldg., Pittsburgh, Pa.
H. F. Nash, Vice Pres. & Genl. Mgr. of Sales, Oakdale Coal Co., Gas and Electric Bldg., Denver, Colo.
Warren R. Roberts, Pres., Roberts & Schaefer Co., Wrigley Bldg., Chicago, Ill.
H. D. Smith, Genl. Supt., American Coal Co. of Allegany County, McComas, W. Va.
C. R. Stahl, Asst. to Genl. Mgr., E. E. White Coal Co., Stotesbury, W. Va.
C. Law Watkins, Vice Pres., Pennsylvania Coal & Coke Corpn., Cresson, Pa.
F. W. Whiteside, Chf. Engr., Victor-American Fuel Co., Ernest & Cranmer Bldg., Denver, Colo.

Underground Power Transmission

A. B. Kiser, *Chairman*

W. A. Chandler, Elec. Engr., Hudson Coal Co., Scranton, Pa.
Harvey Conrad, Genl. Mgr., American Coal Mng. Co., Bicknell, Ind.
L. C. Ilsley, U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.
R. L. Kingsland, Genl. Supt., Power and Mechanical Dept., Consolidation Coal Co., Fairmont, W. Va.
Carl Lee, Elec. Engr., Peabody Coal Co., 1652 McCormick Bldg., Chicago, Ill.
Wm. Schott, Cons. Engr., Big Creek Coal Co. Chicago, Ill.
Henry M. Warren, Cons. Engr., Glen Alden Coal Co., 300 Jefferson Ave., Scranton, Pa.

Power Equipment

F. L. Stone, *Chairman*

W. C. Adams, Allen & Garcia, Chicago, Ill.
Graham Bright, Cons. Engr., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.

How does the METAL MINER *live?*

Top—Store building and employes' cottages of the Phelps Dodge Corporation. Center—Loretta camp. Bottom—Community pool.

VISIBLE EVIDENCE of a company's attention to the welfare of its employes is presented in these pictures taken about camps of the Phelps Dodge Corporation. In the words of the manager of one of their labor departs: "The policies and methods which have been developed for the purpose of securing harmonious relations between the company and the employes, during the 45 years of continuous operation, came about fundamentally for no sentimental or paternalistic reasons, but because it has always been recognized by the management that the interest, good will, and cooperation of the employes was essential to successful operation and good management."

At these properties there has been a sincere effort to solve the problem of the human relationship between employe and management. Working conditions are made as good as possible; there is a safety organization with a safety committee in each operating department; hospitals and medical service, an employes benefit association, and a pension plan are maintained. An employes representation plan is in successful operation. Civic pride and home-owning and permanent communities have resulted.

OFFICERS AND COMMITTEES, 1926—(Continued)

Stephen H. Green, Pacific Coast Coal Co., Seattle, Wash.
O. P. Hood, Chf. Mech. Engr., U. S. Bureau of Mines, Washington, D. C.
J. T. Jennings, Power Engr., Philadelphia & Reading Coal & Iron Co., Pottsville, Pa.
R. L. Kingsland, Consolidation Coal Co., Fairmont, W. Va.
M. D. Kirk, Vesta Coal Co., Jones & Laughlin Bldg., Pittsburgh, Pa.
Chas. Legrand, Cons. Engr., Phelps Dodge Corpn., Douglas, Ariz.
Martin J. Lide, Cons. Engr., Woodward Bldg., Birmingham, Ala.
D. C. McKeehan, Chf. Elec., Union Pacific Coal Co., Rock Springs, Wyo.
J. A. Malady, Master Mech. & Elec. Engr., Hillman Coal & Coke Co., 2307 First National Bank Bldg., Pittsburgh, Pa.
A. J. Nicht, Jr., Engr., Hoisting Equipment, Allis-Chalmers Mfg. Co., Milwaukee, Wis.
W. C. Shunk, Stonega Coal & Coke Co., Big Stone Gap, Va.
Geo. S. Thompson, Chf. Elec. & Master Mech., Colorado Fuel & Iron Co., Pueblo, Colo.
C. D. Woodward, Chf. Elec. Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.

Mine Timbering

R. L. Adams, *Chairman*

SUB-COMMITTEE NO. 1—GENERAL MINE TIMBERING, SIMPLIFICATION ON GRADES AND NAMES

D. F. Holtman (Chairman), Asst. Director, National Committee on Wood Utilization, Dept. of Commerce.
Newell G. Alford, Vice Pres., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
R. W. Austin, Austin & Wood, North 3rd St., Clearfield, Pa.
J. R. Crowe, Jr., Pres., Crowe Coal Co., Dwight Bldg., Kansas City, Mo.
G. A. Knox, Supt., Gunn-Quealy Coal Co., Gunn, Wyoming.
Ernest M. Merrill, Pres., Merrill-Ferguson Engineering Co., 506 Kanawha Bank & Trust Bldg., Charleston, W. Va.
Chas. N. Perrin, Chairman, Rules Committee, National Hardwood Lumber Assn., Bank of Wisconsin Bldg., Madison, Wis.
George S. Rice, Chf. Mng. Engr., U. S. Bureau of Mines, Washington, D. C.
J. R. Sharp, care of C. F. Kurtz Co., Rock Island, Ill.
Geo. T. Stevens, Chf. Engr., Clinchfield Coal Corpn., Dante, Va.

SUB-COMMITTEE NO. 2—PRESERVATION OF MINE TIMBERS

Geo. M. Hunt (*Chairman*), In Charge of Wood Preservation Section, Forest Products Laboratory, Madison, Wis.
W. L. Affelder, Asst. to Pres., Hillman Coal and Coke Co., 2306 First Natl. Bank Bldg., Pittsburgh, Pa.
R. W. Austin, Austin & Wood, North 3rd St., Clearfield, Pa.
M. H. Sellers, Timber Agent, Chicago, Wilmington & Franklin Coal Co., Carbondale, Ill.
D. A. Stout, Mgr., Fuel Dept., Colorado Fuel & Iron Co., Pueblo, Colo.

SUB-COMMITTEE NO. 3—USE OF CONCRETE IN MINE TIMBERING

Newell G. Alford (*Chairman*), Vice-Pres., Howard N. Eavenson & Associates, 1302 Union Trust Bldg., Pittsburgh, Pa.
B. C. Collier, Pres., Cement-Gun Co., Inc., Allentown, Pa.
W. R. Peck, Chf. Engr., Black Diamond Collieries, Coal Creek, Tenn.
H. S. Wright, Engr., Structural Bureau, Portland Cement Assn., 111 W. Washington St., Chicago, Ill.

SUB-COMMITTEE NO. 4—USE OF STRUCTURAL STEEL FOR MINE TIMBERING

D. W. Blaylock, Mng. Engr., Madison Coal Corpn., Glen Carbon, Ill.
J. M. Clark, Jr., Asst. Engr., E. E. White Coal Co., Glen White, W. Va.
R. V. Clay, Wheeling & Lake Erie Coal Mining Co., Cleveland, Ohio.
Robert A. Marble, Carnegie Steel Co., Carnegie Bldg., Pittsburgh, Pa.
Geo. A. Richardson, Mgr., Technical Publicity Dept., Bethlehem Steel Co., Bethlehem, Pa.

SUB-COMMITTEE NO. 5—SALVAGE OF MINE TIMBER

George T. Stevens (Chairman), Chf. Engr., Clinchfield Coal Corpn., Dante, Va.
Davis Read, Chf. Engr., West Kentucky Coal Co., Sturgis, Ky.
A. B. Walter, Chf. Engr., O'Gara Coal Co., Harrisburg, Ill.

METAL MINING BRANCH

General Committee

Charles A. Mitke (*Chairman*), Cons. Mng. Engr., Phoenix, Ariz.
Frank Ayer, Mgr., Moctezuma Copper Co., Nacozari, Sonora, Mexico.
Wm. Conibear, Safety Inspector, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Arthur Crowfoot, Mill Supt., Phelps Dodge Corpn., Morenci, Ariz.
William B. Daly, Genl. Mgr. of Mines, Anaconda Copper Mining Co., 504 Hennessy Bldg., Butte, Mont.
Lucien Eaton, Supt., Ishpeming District, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Wm. H. Gallagher, Jr., Chf. Mng. Engr., Pickands-Mather & Co., 700 Sellwood Bldg., Duluth, Minn.
H. C. Goodrich, Chf. Engr., Utah Copper Co., Kearns Bldg., Salt Lake City, Utah.
T. O. McGrath, Asst. Mgr., Shattuck-Arizona Copper Co., Bisbee, Ariz.
Dr. Frank H. Probert, Dean, College of Mining, University of California, Berkeley, Calif.
Philip D. Wilson, American Metal Co., Ltd., 61 Broadway, New York City.

Mine Drainage

Wm. H. Gallagher, Jr., *Chairman*

H. T. Abrams, Dept. Mgr. of Air Lift Pumps and "Calyx" Drills, Ingersoll-Rand Co., 11 Broadway, New York City.
G. L. Kollberg, Mgr., Pumping Engine Dept., Allis-Chalmers Mfg. Co., Milwaukee, Wis.
O. D. McClure, Chief Mech. Engr., Cleveland-Cliffs Iron Co., Ishpeming, Mich.
Charles Mendelsohn, Master Mechanic, Old Dominion Company, Globe, Ariz.
W. A. Rankin, Elec. Engr., Copper Range Company, Painesdale, Mich.
W. N. Tanner, Chief Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.
C. D. Woodward, Chief Elec. Engr., Anaconda Copper Mining Co., 514 Hennessy Bldg., Butte, Mont.

Drilling Machines and Drill Steel

Frank Ayer, *Chairman*

SUB-COMMITTEE NO. 1—DRILLING MACHINES

B. F. Tillson (*Chairman*), Asst. Supt., New Jersey Zinc Co., Franklin, N. J.
L. C. Bayles, Designing Engr., Rock Drill Dept., Ingersoll-Rand Co., Phillipsburg, N. J.
Arthur B. Foote, Genl. Mgr., North Star Mines Co., Grass Valley, California.
J. A. Fulton, Idaho-Maryland Mines Co., Grass Valley, California.
Roy H. Marks, Efficiency Engr., United Verde Extension Mng. Co., Jerome, Arizona.
R. T. Murrill, Efficiency Engr., St. Joseph Lead Co., Rivermines, Mo.
R. A. Scott, Sales Mgr., Denver Rock Drill Mfg. Co., 39th and Williams St., Denver, Colo.
W. C. Scott, Supt., Morenci Branch, Phelps Dodge Corpn., Metcalf, Ariz.
George A. Shaw, Mine Supt., Talache Mines, Inc., Talache, Idaho.
H. T. Walsh, Vice Pres., Sullivan Machinery Co., Peoples Gas Bldg., Chicago, Ill.

SUB-COMMITTEE NO. 2—DRILL STEEL

Norman B. Braly, Genl. Mgr., North Butte Mng. Co., Butte, Mont.
E. G. Deane, Mgr., Superior & Boston Copper Co., Copper Hill, Ariz.
O. J. Egleston, Mgr., U. S. Smelting, Refining & Mining Co., Kennett, Calif.
C. S. Elayer, Clouderoft, New Mexico.
E. F. Hastings, Salesman, Ingersoll-Rand Co. of Texas, Dominion Hotel, Globe, Ariz.
Chas. S. Hurter, Tech. Representative, E. I. du Pont de Nemours & Co., Inc., 5104 Du Pont Bldg., Wilmington, Del.
Charles B. Officer, Asst. to Pres., Sullivan Machinery Co., 122 So. Mich. Ave., Chicago, Ill.
Henry S. Potter, Managing Director, Henry S. Potter, Ltd., 26 Cullinan Bldg., Johannesburg, South Africa.
Ocha Potter, Supt., Ahmeek-Kearsarge Br., Calumet & Hecla Mng. Co., Ahmeek, Mich.
Chas. A. Smith, Asst. Genl. Mgr., Ray Consolidated Copper Co., Ray, Ariz.
A. S. Uhler, Mgr., Rock Drill Sales, Ingersoll-Rand Co., 11 Broadway, New York City.
M. van Sielen, Engr., In Charge of Mining Research, U. S. Bureau of Mines, Washington, D. C.
Bruce C. Yates, Supt., Homestake Mining Co., Lead, South Dakota.

SUB-COMMITTEE NO. 3—METHODS OF SHARPENING DRILL STEEL

W. R. Wade (Chairman), Cons. Engr., 1230 Geary St., San Francisco, Calif.
George H. Gilman, Pres., Gilman Mfg. Co., E. Boston, Mass.
Chas. E. Lees, Supt., Iron Cap Copper Co., Copper Hill, Ariz.
Frank W. McLean, United Verde Copper Co., Jerome, Ariz.
W. H. Schacht, Genl. Mgr., Copper Range Co., Painesdale, Mich.
H. W. Seamon, Supt., Comstock Merger Mines, Inc., Virginia City, Nevada.

Underground Transportation

William B. Daly, *Chairman*

Thos. C. Baker, Genl. Mgr., The Comstock Merger Mines Co., Virginia City, Nevada.
George H. Booth, Mech. Engr., Inspiration Cons. Co., Inspiration, Arizona.
R. R. Boyd, Asst. Supt., Mine Dept., Copper Queen Branch, Phelps Dodge Corpn., Bisbee, Arizona.
D. S. Calland, Managing Director, Compania de Real del Monte de Pachuca, Pachuca, Hidalgo, Mexico.
W. R. Crane, Supt., Southern Station, U. S. Bureau of Mines, New Federal Bldg., Birmingham, Alabama.
W. Val DeCamp, Genl. Mine Supt., United Verde Copper Co., Jerome, Arizona.
Robert H. Dickson, Supt., 85 Branch, Calumet & Arizona Mining Co., Valedon, New Mexico.
Stanly A. Easton, Mgr., Bunker Hill & Sullivan Mng. & Concentrating Co., Kellogg, Idaho.
H. T. Hamilton, Cons. Mng. Engr., 1408 California Commercial Union Bldg., San Francisco, California.
F. H. Hayes, Mine Supt., Copper Queen Branch, Phelps Dodge Corpn., Bisbee, Arizona.
R. E. Howe, Genl. Supt., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.
John Kiddie, Mine Supt., Phelps Dodge Corpn., Morenci, Arizona.
C. A. Lantz, Genl. Mgr., Compania de Santa Gertrudis, S. A., Apartado No. 1, Pachuca, Hidalgo, Mexico.
E. M. Norris, Asst. Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
Thomas K. Scott, Supt., Munro Iron Mining Co., Iron River, Mich.
Andover Syverson, Prescott, Arizona.

Fire-Fighting Equipment

Wm. Conibear, *Chairman*

SUB-COMMITTEE NO. 1—CONTROL OF VENTILATING EQUIPMENT DURING MINE FIRES

Orr Woodburn (*Chairman*), Safety Engr., Globe-Miami District, Globe, Ariz.
Guy J. Johnson, Mgr., Golden Gate Mine and Timber Co., Atlantic City, Wyo.
H. J. Rahilly, Supt., Mine Fire and Hydraulic Filling Dept., Anaconda Copper Mining Co., Butte, Mont.
Albert Tallon, Safety Inspector, The Old Dominion Co., Globe, Ariz.
J. T. Young, Safety Inspector, Arizona Copper Company, Morenci, Ariz.

SUB-COMMITTEE NO. 2—FIRE HOSE

R. H. Seip (*Chairman*), New Jersey Zinc Co., Franklin, N. J.
C. W. Moon, Safety Inspector, Phelps Dodge Corpn., Bisbee, Ariz.
B. O. Pickard, District Engineer, U. S. Bureau of Mines, Berkeley, Calif.

Mining Excavating Equipment—Exclusive of Dredges

H. C. Goodrich, *Chairman*

H. G. S. Anderson, Mng. and Met. Engr., Rolla, Mo.
H. C. Bellinger, Vice Pres., Chile Exploration Co., 25 Broadway, New York City.
Michael Curley, Genl. Supt., New Cornelia Copper Co., Ajo, Ariz.
H. T. Gracely, Adv. Mgr., Marion Steam Shovel Co., Marion, Ohio.
C. B. Lakenan, Genl. Mgr., Nevada Cons. Copper Co., McGill, Nev.
W. J. Lester, Pres., Kentucky Washed Coal Co., Greenville, Ky.
C. H. Matthews, Genl. Engineering Dept., Westinghouse Mlec. & Mfg. Co., E. Pittsburgh, Pa.
Geo. Meyr, Supt., Sacramento Hill, Copper Queen Branch, Phelps Dodge Corpn., Bisbee, Ariz.
G. A. Murfey, Treas. and Chief Engr., The Browning Co., 16226 Waterloo Rd., Cleveland, Ohio.
Henry B. Oatley, Vice Pres., Superheater Co., 17 E. 42nd St., New York City.
Thos. A. Snyder, Bucyrus Co., South Milwaukee, Wis.
Robt. E. Tally, Genl. Mgr., United Verde Copper Co., Jerome, Ariz.
J. C. Wheat, Development Engr., Industrial Works, Bay City, Mich.
Charles S. Whitaker, Vice Pres., Winston Bros. Co., 801 Globe Bldg., Minneapolis, Minn.

Mine Ventilation

Chas. A. Mitke, *Chairman* (*Temporary*)

Robt. N. Bell, Cons. Mng. Engr., Box 1339, Boise, Idaho.
Walter C. Browning, Genl. Mgr., Magma Copper Co., Superior, Ariz.
O. K. Dyer, Mgr., Small Blower Dept., Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Daniel Harrington, 507 Newhouse Bldg., Salt Lake City, Utah.
E. T. Lednum, Mgr., E. I. du Pont de Nemours & Co., Inc., 406 Ideal Bldg., Denver, Colo.
C. E. Legrand, Cons. Engr., Phelps Dodge Corpn., Douglas, Ariz.
F. W. Maclennan, Genl. Mgr., Miami Copper Co., Miami, Ariz.
Don M. Rait, Asst. Supt. of Mines, Calumet and Arizona Mining Co., Warren, Ariz.
A. S. Richardson, Ventilation Engr., Anaconda Copper Mining Co., Butte, Mont.
Wm. A. Rowe, Chief Engr., American Blower Co., 6004 Russell St., Detroit, Mich.
A. C. Stoddard, Chief Mine Engr., Inspiration Cons. Copper Co., Inspiration, Ariz.
F. L. Stone, Industrial Engineering Dept., General Electric Co., Schenectady, N. Y.
E. B. Williams, Mgr., Marine Dept., B. F. Sturtevant Co., Hyde Park, Boston, Mass.

OFFICERS AND COMMITTEES, 1926—(Concluded)

Mechanical Loading Underground

Lucien Eaton, *Chairman*

SUB-COMMITTEE NO. 1—LOADING MACHINES FOR TUNNELS, LARGE DRIFTS AND STOPES

Douglas C. Corner (*Chairman*), St. Louis Power Shovel Co., 320 Chemical Bldg., St. Louis, Mo.
H. E. Billington, Vice Pres. for Sales, The Thew Shovel Co., Lorain, Ohio.
J. H. Hensley, Mine Supt., Miami Copper Co. Miami, Ariz.
H. DeWitt Smith, New York Trust Co., 100 Broadway, New York City.
H. G. Washburn, Asst. Genl. Mgr., Federal Mng. & Smelting Co., Wallace, Idaho.
William Whaley, Genl. Mgr., Myers-Whaley Co., Knoxville, Tenn.

SUB-COMMITTEE NO. 2—LOADING MACHINES FOR SMALL DRIFTS AND FOR WORK ON SUB-LEVELS

G. R. Jackson (*Chairman*), Supt., Cleveland-Cliffs Iron Co., Negaunee, Mich.
C. L. Berrien, Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
H. H. Talboys, Mgr., Shuveloder Dept., Nordberg Mfg. Co., Milwaukee, Wis.
Chas. E. Van Barneveld, Chatsworth, Calif.

SUB-COMMITTEE NO. 3—SCRAPERS

Lucien Eaton (*Chairman*), Supt., Ishpeming District, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
C. L. Kohlhaas, Denver Rock Drill Co., Duluth, Minn.
Ward Royce, Ingersoll-Rand Co., Houghton, Mich.
E. E. Whiteley, Supt. of Mines, Calumet & Arizona Mining Co., Warren, Ariz.

Mine Timbering

Frank H. Probert, *Chairman*

SUB-COMMITTEE NO. 1—PRESERVATION OF MINE TIMBERS

Geo. M. Hunt (*Chairman*), In Charge of Section of Wood Preservation, Forest Products Laboratory, Madison, Wis.
J. H. Hensley, Miami Copper Co., Miami, Ariz.
Gerald Sherman, Cons. Mng. Engr., Phelps Dodge Corpn., Douglas, Ariz.

SUB-COMMITTEE NO. 2—GUNITE AS A SUBSTITUTE FOR TIMBER, ITS PROPER APPLICATIONS AND ITS LIMITATIONS

E. M. Norris (*Chairman*), Asst. Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
B. C. Collier, Pres., Cement-Gun Co., Inc., Allentown, Pa.
R. R. Horner, Cons. Engr., U. S. Bureau of Mines, Clarksburg, W. Va.

SUB-COMMITTEE NO. 3—DETERMINATION OF SIZE AND SHAPE OF DRIFTS AND DRIFT TIMBERS FOR VARIOUS PURPOSES, WITH A VIEW TO REDUCING SAME TO CERTAIN STANDARD SIZES AND SHAPES

Dr. F. W. Sperr (*Chairman*), Professor of Civil and Mining Engineering, Michigan College of Mines, 315 Florence St., Houghton, Mich.
C. L. Berrien, Genl. Supt. of Mines, Anaconda Copper Mining Co., Butte, Mont.
Felix McDonald, Mines Supt., Inspiration Cons. Copper Co., Inspiration, Ariz.

SUB-COMMITTEE NO. 4—COOPERATION BETWEEN OPERATORS AND LUMBER DEALERS AND MANUFACTURES, WITH A VIEW TO ASCERTAINING WHETHER FURTHER STANDARDIZATION IN SIZES AND SHAPES OF LUMBER UNDERGROUND WOULD RESULT IN A REDUCTION IN COST TO MINING COMPANIES

Charles F. Willis (*Chairman*), Editor and Publisher, Arizona Mining Journal, Phoenix, Ariz.
W. S. Boyd, Genl. Mgr., Ray Cons. Copper Co., Ray, Ariz.
T. Evans, Genl. Mgr., Cananea Cons. Copper Co., Cananea, Sonora, Mexico.
D. F. Holtman, Asst. Director, National Committee on Wood Utilization, Department of Commerce.
G. R. Jackson, Supt., Negaunee Mine, Cleveland-Cliffs Iron Co., Negaunee, Mich.
John Kiddie, Mine Supt., Phelps-Dodge Corpn., Morenci, Ariz.
W. G. McBride, Genl. Mgr., Old Dominion Co., Globe, Ariz.

Mine Accounting

T. O. McGrath, *Chairman*

L. S. Cates, Vice-Pres. and Genl. Mgr., Utah Copper Co., Salt Lake City, Utah.
J. C. Dick, Mng. Engr., 511 Newhouse Bldg., Salt Lake City, Utah.
L. K. Diffenderfer, Secy. and Treas., Vanadium Corporation of America, 120 Broadway, New York City.
H. B. Fernald, Loomis-Suffern & Fernald, 50 Broad St., New York City.
H. H. Miller, General Auditor, Hercules Mining Company, Wallace, Idaho.
H. L. Norton, Phelps-Dodge Corpn., Douglas, Ariz.
Harry Vivian, Chief Engr., Calumet & Hecla Cons. Copper Co., Calumet, Mich.

Milling and Smelting Practices and Equipment

Arthur Crowfoot, *Chairman*

SUB-COMMITTEE NO. 1—MILLING PRACTICES AND EQUIPMENT

Arthur Crowfoot (Chairman), Mill Supt., Phelps-Dodge Corpn., Morenci, Ariz.
H. G. S. Anderson, Rolla, Mo.
Herman C. Bellinger, Vice-Pres., Chile Exploration Co., 25 Broadway, New York City.
Allan J. Clark, Supt. of Mills, Homestake Mining Co., Lead, S. Dak.
G. R. Delamater, Fuel Engr., W. S. Tyler Co., Superior St., Cleveland, Ohio.
W. M. Drury, Genl. Mgr., Mining Dept., American Smelting and Refining Co., El Paso, Tex.
Guy H. Ruggles, Mill Supt., Inspiration Cons. Copper Co., Inspiration, Ariz.
Henry A. Tobelmann, Cons. Engr. and Chemist, Associated Industries, 21 E. 40th St., New York City.
William Young Westervelt, Cons. Mng. Engr., 522 Fifth Ave., New York City.

SUB-COMMITTEE NO. 2—SMELTING PRACTICES AND EQUIPMENT

J. Owen Ambler, Smelter Supt., Phelps-Dodge Corpn., Clifton, Ariz.
P. P. Butler, Supt. of Douglas Reduction Works, Phelps-Dodge Corpn., Douglas, Ariz.
Harry A. Clark, Smelter Supt., Calumet and Arizona Mining Co., Douglas, Ariz.
Kuno Doerr, Genl. Mgr., Southwestern Dept., American Smelting & Refining Co., El Paso, Tex.
F. L. Flynn, Toltec Club, El Paso, Tex.
Professor Carle R. Hayward, Associate Professor of Metallurgy, Mass. Institute of Technology, Cambridge, Mass.
George W. Prince, Asst. Genl. Mgr., United Verde Extension Mining Co., Clemenceau, Ariz.
Forest Rutherford, Cons. Metallurgical Engr., 50 Broad St., New York City.

Methods of Mine Sampling, Methods of Recording Underground Geological Data, and Methods of Estimation of Ore Reserves For Low Medium and High Grade Ore bodies

Philip D. Wilson, *Chairman*

Guy Bjorge, Cons. Mng. Engr., 1400 Hawthorne Terrace, Berkeley Calif.
E. L. Derby, Jr., Chief Geologist, Cleveland-Cliffs Iron Co., Ishpeming, Mich.
M. J. Elsing, Mng. Engr. and Geologist, Warren, Ariz.
Dr. L. C. Graton, Professor of Geology, Harvard University, Cambridge, Mass.
Julius Kruttschnitt, Jr., Mgr., Mining Dept. of the Southwest, American Smelting and Refining Co., Tucson, Ariz.
F. A. Linforth, Asst. Chf. Geologist and Asst. Chf. Mng. Engr., Anaconda Copper Mining Co., 526 Hennessy Bldg., Butte, Mont.
Albert Mendelsohn, Underground Supt., Champion Copper Co., Painesdale, Mich.
MacHenry Mosier, Asst. Mine Supt., Morenci Branch, Phelps-Dodge Corpn., Morenci, Ariz.
Louis E. Reber, Jr., Chf. Geologist, United Verde Copper Co., Jerome, Ariz.
T. Skewes Saunders, Cons. Mng. Engr., Av. Cinco de Mayo 10, Despacho 33, Mexico, D. F.
J. B. Tenney, Geologist, Copper Queen Branch, Phelps-Dodge Corpn., Bisbee, Ariz.
Robert W. Thomas, Supt. of Mines, Ray Cons. Copper Co., Ray, Ariz.

Joint Publicity Committee

Representing Coal Mining Branch:

Ralph C. Becker, Keystone Consolidated Publishing Co., care McGraw-Hill Publishing Co., 10th Ave. at 36th St., New York City.
C. H. Trik, Sales and Mine Ventilation Engr., Jeffrey Mfg. Co., Columbus, Ohio.

Representing Metal Mining Branch:

T. O. McGrath, Asst. Mgr., Shattuck-Arizona Copper Co., Bisbee, Ariz.
Charles F. Willis, Editor and Publisher, Arizona Mining Journal, Phoenix, Ariz.

COMMITTEES

COOPERATION

AMERICAN MINING CONGRESS AND AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

A. M. C.

A. Cressy Morrison, 30 E. 42nd St., New York City.
J. E. Spurr, Hill Bldg., New York City.
W. R. Ingalls, 115 Broadway, New York City.
J. R. Finlay, 170 Broadway, New York City.
Daniel B. Wentz, Land Title Bldg., Philadelphia, Pa.

A. I. M. & M. E.

E. P. Mathewson, 42 Broadway, New York City.
W. L. Saunders, 11 Broadway, New York City.
Walter Douglas, 99 John St., New York City.
Benjamin B. Thayer, 25 Broadway, New York City.
Samuel Taylor, Second National Bank Bldg., Pittsburgh, Pa.

ALASKAN AFFAIRS

John A. Davis, U. S. Bureau of Mines, Washington, D. C.
Falcon Joslin, 2203 L. C. Smith Bldg., Seattle, Wash.
Bart L. Thane, 408 Crocker Bldg., San Francisco, Calif.

MINING IN FOREIGN COUNTRIES

J. E. Spurr, *Chairman*, Hill Bldg., New York City.
Van H. Manning, 15 West 44th St., New York City.
E. L. Doheny, 120 Broadway, New York City.
W. J. Loring, Merchants National Bank Bldg., Los Angeles, Calif.
Matthew C. Fleming, New York City.
H. Foster Bain, 29 W. 39th St., New York City.

ADVISORY COMMITTEE UNITED STATES BUREAU OF MINES AND GEOLOGICAL SURVEY

Bulkeley Wells, *Chairman*, San Francisco, Calif.
Walter Douglas, New York City.
Rembrandt Peale, New York City.
H. Foster Bain, 29 W. 39th St., New York City.
George Otis Smith, U. S. Geological Survey, Washington, D. C.

COOPERATION INTERNAL REVENUE DEPARTMENT

J. F. Callbreath, American Mining Congress, Munsey Bldg., Washington, D. C.
John T. Barnett, 1024 Lafayette St., Denver, Colo.
Paul Armitage, 2174, 233 Broadway, New York City.
L. C. Boyle, Kansas City, Mo.
Rush C. Butler, Chicago, Ill.

OPERATORS' CO-OPERATING COMMITTEE

PETROLEUM

J. G. BRADLEY, *Chairman*
J. F. CALLBREATH, *Secretary*

E. L. Doheny, Mexican Petroleum Co., 120 Broadway, New York City.
George S. Davidson, Gulf Refining Co., Pittsburgh, Pa.
A. L. Beaty, Texas Co., 17 Battery Pl., New York City.
H. F. Sinclair, Sinclair Oil Co., 45 Nassau St., New York City.
Walter Teagle, Standard Oil Co. of N. J., New York City.

METALS

Bulkeley Wells, Hobart Bldg., San Francisco, Calif., Gold.
F. B. Richards, Leader-News Bldg., Cleveland, Ohio, Iron.
Edgar Z. Wallower, Joplin, Mo., Zinc.
B. B. Thayer, 25 Broadway, New York City, Copper.

COAL

J. G. Bradley, Elk River Coal & Lumber Co., Dundon, W. Va.
T. H. Watkins, Pennsylvania Coal & Coke Corp., New York City.
E. W. Parker, Anthracite Bureau of Information, Philadelphia, Pa.
Albert Nason, Nason Coal Co., Chicago, Ill.
J. G. Puterbaugh, McAlester Fuel Co., McAlester, Okla.
S. D. Warriner, Lehigh Coal & Navigation Co., Philadelphia, Pa.

COAL EXPORTS

Geo. S. Rice, Bureau of Mines, Washington, D. C.
John Callahan, Woodward Bldg., Washington, D. C.
Chas. A. Owen, Pres., Imperial Coal Corporation, 17 Battery Pl., New York City.
G. A. O'Reilly, Irving National Bank, New York City.

(From the Craftsman's Dictionary)

Grotesques

Grotesques—a fanciful kind of ornament that arose in the Middle Ages expressing ideas extraneous to the design of which it was a part.

These fantasies, which took their name from the grottoes of Italy in which they originated, were evolved by men who so knew their craft that they brought whimsical song from the very chains of it. They are the outgrowth of that spirit that gives the extra lilt that raises the melody to the exquisite; a spirit that bubbles out over the bounds of a mastered craft — that stands at the opposite pole of the craft from that producing the pot-boiler; a spirit the importance of which even Bacon, in his methodical search for common sense, rather awkwardly admits in his essay on beauty when he describes his subject as being called forth "by a kind of felicity (as a musician that maketh an excellent air in music) and not by rule."

Grotesques were produced by men, who, through a playful imaginativeness, gave life to the laws of the craft they knew and loved. Such men are those of that day or this who, in reaching out beyond their craft, have been searching for the meaning back of it and the ideals beyond. And in tracking down these trails they are sensing the time when all such paths approach the same high road of universal understanding and cooperation.

We of our craft realize that mining has gone far from the days when it was a greedy grubbing in the earth for wealth; that it is, instead, an important and intricately adjusted industry at the base of most that is constructive in our modern civilization. Even the public is beginning to realize this. Renew your vision of the scope of the activities of modern mining by looking over the committees on the foregoing pages. We are proud of the work they are doing.

The clarity of our own vision helps to carry the torch of understanding.

INDEX TO ADVERTISERS

	Page
Allis-Chalmers Mfg. Co.	10
Ameling Prospecting Co., Inc., H. R.	27
American Mine Door Co.	25
American Steel & Wire Co.	10
Boyle, John, Jr.	29
Cameron Steam Pump Works, A. S. (Ingersoll-Rand Co.)	18
Car Dumper & Equipment Co.	27
Central Frog & Switch Co.	27
Central Steel Co.	6
Connellsville Mfg. & Mine Supply Co.	25
Diamond Machine Co.	25
DuPont de Nemours & Co., Inc., E. I.	15
Ellis Mill Co.	27
Fawcus Machine Co.	27
General Coal Co.	19
General Electric Co.	7
Goodman Mfg. Co.	13
Hercules Powder Co.	3
Hoffman Brothers	27
Hyatt Roller Bearing Co.	Inside Front Cover
Ingersoll-Rand Co. (A. S. Cameron Steam Pump Works)	18
Irvington Smelting & Refining Works	27
Jeffrey Mfg. Co.	4
Johnson Mfg. Co., G. M.	29
Keystone Churn Drill Co.	23
Keystone Lubricating Co.	25
Lehigh Coal & Navigation Co.	29
Ludlow-Saylor Wire Co.	11, 12
Missouri Pacific Lines	14
Morse Chain Co.	Back Cover
Mt. Vernon Car Mfg. Co.	29
Nuttall Co., R. D.	23
Ohio Brass Co.	23
Patrick, R. S.	23
Phelps Dodge Corp.	27
Prest-O-Lite Co., Inc.	21
John A. Roebling's Sons Co.	25
Stonehouse Signs, Inc.	27
Thorne Neale & Co., Inc.	19
Willmarth, O. Barlow	29

A Virginia Clay Mine

Rediscovering An Old Frontier!

THE FRONTIER OF THE NATION has swung back to its beginnings. After following bonanzas and developing mines throughout the land it is discovering the great wealth that lies at its own front door. A recent survey by the American Mining Congress developed the fact that there are 83 valuable minerals, as yet practically undeveloped, to be found in quantity in the Southern States.

The Industrial Development Conference to be held at Memphis, Tennessee, March 15, 16 and 17, by the Southern Division of the American Mining Congress, will pave the way for the opening of this great mineral storehouse. It will be the clearing house of information upon these resources. It will establish contact between producer and consumer and will bring together investment capital and dormant resources. The scope of this convention is outlined more fully in the text pages of this Journal.

For further information, hotel reservation, program and reduced railroad certificate, address The American Mining Congress, Chamber of Commerce Building, Memphis, Tennessee.

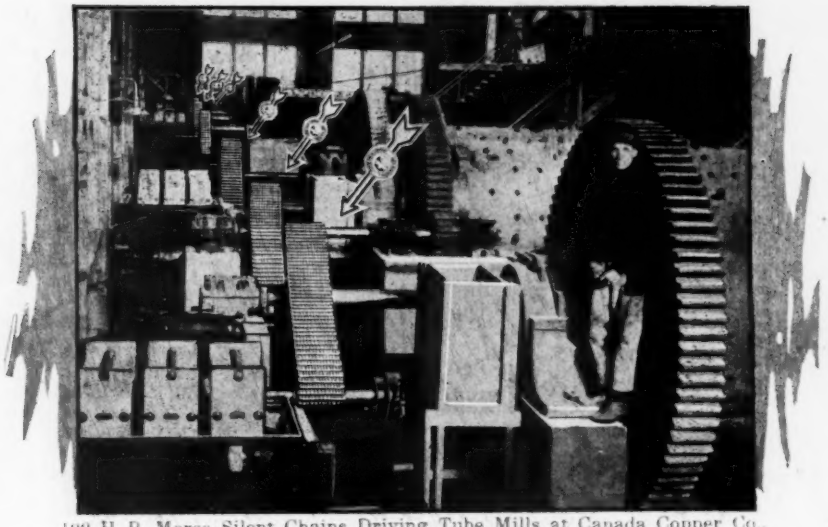
INDUSTRIAL DEVELOPMENT CONFERENCE

Southern Division, The American Mining Congress

MEMPHIS, TENN. MARCH 15-17

MORSE SILENT CHAIN DRIVES

THE MORSE "ROCKER JOINT"



100 H. P. Morse Silent Chains Driving Tube Mills at Canada Copper Co., Allenby, B. C., Canada

Hidden in the cost per ton

Power costs are an important item in determining the ultimate cost per ton. Reliable and efficient power drives will do much toward lowering these costs. In fact, their own cost will be hidden in the final result. In almost every type of service, Morse Silent Chain Drives have proved their efficiency, reliability and durability.

Over 5,000,000 H. P. in use, one tenth to 5,000 H. P., 6,000 to 250 r.p.m. and slower. The nearest Morse Engineer is always available.

A Power Saver for Power Users

MORSE CHAIN CO., ITHACA, N. Y.

There is a Morse Engineer near you

ATLANTA, GA.....702 Candler Bldg., Earl F. Scott & Co.
BALTIMORE, MD.....1402 Lexington Bldg.
BIRMINGHAM, ALA.....Moore Handley Hardware Co.
BOSTON, MASS.....141 Milk St.
CHARLOTTE, N. C.....404 Commercial Bank Bldg.
CHICAGO, ILL.....112 West Adams St.
CLEVELAND, OHIO.....421 Engineers Bldg.
DENVER, COLO.....211 Ideal Bldg.
DETROIT, MICH.....7601 Central Ave.
LOUISVILLE, KY.....516 W. Main St., E. D. Morton Co.
MINNEAPOLIS, MINN.....413 Third St., Strong-Scott Mfg. Co.
NEW ORLEANS, LA.....521 Barronne St., A. M. Lockett Co.
NEW YORK, N. Y.....50 Church St.
OMAHA, NEB.....727 W.O.W. Bldg., D. H. Braymer Equip. Co.
PHILADELPHIA, PA.....803 Peoples Bank Bldg.
PITTSBURGH, PA.....Westinghouse Bldg.
SAN FRANCISCO, CALIF.....Monadnock Bldg.
ST. LOUIS, MO.....2137 Railway Exchange Bldg.
TORONTO 2, ONT., CAN.....50 Front St., Strong-Scott Mfg. Co.
WINNIPEG, MAN., CAN.....Dufferin St., Strong-Scott Mfg. Co.

682

RANSDELL INCORPORATED, PRINTERS, WASHINGTON, D. C.